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DEPARTMENT OF MINES.

MEMOIRS OF THE GEOLOGICAL SURVEY OF NEW SOUTH WALES.
C. S. WILKINSON, F.G.S., &c., GEOLOGICAL SURVEYOR-IN-CHARGE.

PALÆONTOLOGY, No. 3.

R. ETHERIDGE, JNR., PALÆONTOLOGIST.

GEOLOGICAL AND PALÆONTOLOGICAL RELATIONS
OF THE
COAL AND PLANT-BEARING BEDS OF PALÆOZOIC AND MESOZOIC AGE
IN
EASTERN AUSTRALIA AND TASMANIA;
WITH
SPECIAL REFERENCE TO THE FOSSIL FLORA.

Described, illustrated, and compared with Analogous Deposits in other Countries

BY

OTTOKAR FEISTMANTEL, M.D., C.M.R.S., N. S. Wales, &c.,
Professor in the Bohemian Polytechnic University, Prague; formerly Palæontologist, Geological Survey of India.

ISSUED BY DIRECTION OF THE HON. SYDNEY SMITH, M.P., MINISTER FOR MINES AND AGRICULTURE.

SYDNEY: CHARLES POTTER, GOVERNMENT PRINTER.
1890.

209745

EDITOR'S PREFACE.

In the capacity of Editor of the Palæontological Memoirs of the Geological Survey it affords me much pleasure to pass through the press Professor O

ERRATA.

Page 35, line 35.—*For* Ballinore Coal-field and Talbragar Mines, *read* Ballimore Hill and Talbragar Coal-field.

Page 40, line 28.—*For* Talbragar Mines, *read* Ballimore Hill.

Page 40, line 34.—For *Odontoperis*, read *Odontopteris*.

Page 44, line 36.—*For* 1876, *read* 1878.

Page 58, line 25.—*For* uniformally, *read* uniformly.

11*a* 104—89

work is inclusive only to 1887.

R. ETHERIDGE, Jun.

Sydney, December, 1889.

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AUTHOR'S PREFACE.

IN the years 1878 and 1879 I published, in German, a work[*] on the Palæozoic and Mesozoic Flora of Eastern Australia, which appeared in the *Palaeontographica*, Suppl. Bd. III, illustrated by thirty plates of fossil plants. I was at that time on the Geological Survey of India,[†] Calcutta, working out the Fossil Flora of the Indian Gondwána-System, which has certain analogies with the coal-bearing beds of Eastern Australia. From this point of view I was also desirous of obtaining a thorough knowledge of the fossil plants of Australia as well as of the geological relations in connection with the same.

The late Rev. W. B. Clarke, of Sydney, forwarded to me for this purpose in 1876 a collection of Australian fossil plants, which in 1878 was supplemented by another smaller, but nevertheless very interesting, series of specimens, with such information as appeared useful and necessary for the understanding of the relative position of the various fossils.

Subsequently I also received several specimens, with further useful information, from Mr. C. S. Wilkinson, Government Geologist of New South Wales.

Upon these collections my above-mentioned work on the Australian Fossil Flora was based.

On the 2nd of July, 1886, I received a letter from Mr. C. S. Wilkinson (dated Sydney, 21st May), in which he suggests a new edition of the above work in English.

This was of course a very honourable and welcome offer to me, and I did my best to ascertain from the original publishers under what conditions the thirty plates could be republished. The writing of the manuscript and bringing it up to date I was willing to undertake myself.

---

[*] Palaeozoische und mesozoische Flora des östlichen Australiens. *Palaeontographica, Suppl. Bd. III, Lieferung III, Heft* 2, 3, 4 (Cassel, 1878 und 1879).

[†] From March, 1875, to March, 1883.

Through the kind exertions of Mr. C. S. Wilkinson, and through the liberality of the Government of New South Wales, the publication of my work on the Australian Fossil Flora was called into existence, and I therefore tender to both my sincerest thanks for this act of kindness.

The lithographic plates were very fairly executed by the publishing firm of Theodor Fischer, at Cassel, to whom also my best acknowledgments are due.

The illustrations are copies of my original plates (but differently arranged) with a few additions.

I have endeavoured to make the text as complete as possible and to bring it up to date, so far as all the various papers were accessible to me here; I only hope that I have satisfied the expectations of the Government of New South Wales.

DR. OTTOKAR FEISTMANTEL.

Prague, 1887.

Department of Mines,
Geological Branch,
29th May, 1889.

SIR,

I have the honour to submit the accompanying Memoir, No. 3 of the *Palæontological Series* of the Geological Survey of New South Wales, on *The Palæozoic and Mesozoic Flora of Australia and Tasmania*, by Dr. Ottokar Feistmantel, Professor in the Bohemian Polytechnic University, Prague. It has been edited by Mr. Robert Etheridge, junr., Palæontologist.

This valuable work comprises chiefly a description of a collection of fossil plants forwarded to Professor Feistmantel, then Palæontologist to the Geological Survey of India, by the late Rev. W. B. Clarke and myself. It was originally issued in German in the *Palaeontographica*, Suppl. Bd. III, 1878-79 (Cassel, 4to).

When I proposed the publication of an English translation of the work, the Professor not only very kindly undertook to furnish the translation, but to revise it and supply additional illustrative plates, so as to include later information received by him to date, 1887.

Since then, however, fresh discoveries have enabled us to determine more definitely the stratigraphical position of certain formations, the correlation of which, as suggested by the Professor from the limited data then before him, has now to be modified; and many doubtful points yet await settlement which can only be accomplished by further geological survey of particular localities. Consequently it has been deemed unnecessary to republish in full the quotations from the published works of some authors and the remarks thereon which Professor Feistmantel has given in this Memoir, for they have now only an historic interest; but his descriptive references to these works are here inserted as they form a valuable record of the literature of the subject.

The palæontological observations regarding the comparison of the Coal-bearing Series of Australia with those of Tasmania, New Zealand, India, Africa, &c., are of special interest; and a lengthy discussion is given as to the age of the boulder-beds in the deposition of which ice action is believed to have been concerned. Much stress is laid upon the occurrence of these boulder-beds as evidence of their contemporaneity; and Professor Feistmantel accordingly adduces it in support of his correlation of the different formations in the above-mentioned countries. I am of opinion, however, that too much stress has been laid upon this point and that this correlation must for the present be regarded only as provisional. I have closely examined the boulder-beds of Bacchus Marsh, in Victoria, and those of the Upper Marine Series of Greta and Branxton in New South Wales, and consider that their contemporaneity is extremely doubtful.

This question leads into a wide field for investigation, and it is well that it has been here introduced, for I trust that it will engage the attention of many geological observers.

I may mention that the plates illustrating this Memoir were carefully drawn under the personal supervision of Professor Feistmantel.

I have added foot-notes on certain stratigraphical points to pp. 28, 41, and 73, bearing my initials.

I have the honour to be,
Sir,
Your obedient servant,
C. S. WILKINSON,
Geological Surveyor-in-Charge.

HARRIE WOOD, ESQ, J.P.,
Under Secretary for Mines.

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PART I.—STRATIGRAPHICAL RELATIONS OF THE COAL AND PLANT-BEARING BEDS.

In Eastern Australia—viz., in New South Wales, Queensland, and Victoria, as well as in Tasmania—there is, above rocks of Devonian age, a series of beds, which is interesting and important from a twofold reason.

1. Certain of the beds contain, in some parts of the provinces named, valuable coal deposits, which very often are simply designated as the "Coal-formation" of those countries.

2. To a great extent, however, these beds contain a Flora which is neither met with in the European nor in the American true coal-formation, but which has a more recent character. Similar deposits are found in India, and also in Southern Africa.

The chief question was to determine approximately the position which these beds occupy, if compared with the sequence of geological formations in Europe and elsewhere, and it was especially Australia which was called upon to furnish the chief points in solving the question, for in that country there are in one portion of the coalbeds certain genera of fossil plants, occurring also in India and Africa, associated with marine animals of undoubtedly Carboniferous age, and thus it was presumed by some authors that also the higher beds in Australia, as well as the beds in India and Africa, containing the same plants, must be of the same age, while others, considering the plants alone, claimed a younger age for the rocks containing the fossils mentioned.

It was my task, when engaged on the Geological Survey of India, to work out the fossil plants of the Indian coal deposits (Gondwána System); this, however, made it necessary to study also the fossil plants and similar relations in Australia, Africa, and elsewhere. It will thus be necessary to notice, in the course of this work, the Floras of the other countries mentioned.

I therefore propose to proceed in the following order: I shall at first analyse the geological and palæontological relations in the various Provinces of Eastern Australia according to the existing literature; I shall compare them with each other, and shall enumerate the fossils according to the horizons and localities. Then will follow the description, in systematic order, and, at last, analogous Floras in other countries will be noticed and brought into comparison with those of Australia.

NEW SOUTH WALES.

The geological relations of this Province appear to be best known, and from here also the fossils of the coal beds were first described. The various papers on the geological and palæontological relations of New South Wales are rather numerous, and I shall therefore discuss the most important of them, just to show what views about the age of the coal-bearing rocks in New South Wales were held by the various authors, and to be able to deduce therefrom the general sequence of geological strata in that country, and to arrive also at a thorough knowledge of the fossils described from the coal-bearing and related beds.

Literary Review.

(1.) 1828. Brongniart (Alex.) **Prodrome d'une Histoire des Végétaux fossiles.** 8*vo. Paris,* 1828. (*pp.* 151 *and* 175).

Describes *Phyllotheca australis*, and mentions *Glossopteris* from Australia (N. S. Wales). The locality for *Phyllotheca* was vaguely given thus: "Hawkesbury River, near Port Jackson, New South Wales." No horizon is, however, mentioned from which the fossil came.

(2.) 1828. Brongniart (Alex.) **Histoire des Végétaux fossiles.** 2 *vols.* 4*to. Paris,* 1828.

Here *Glossopteris Browniana* var. *australasica* is at first described (p. 223, Pl. LXII, Fig. 1), but as coming from the coal formation in New South Wales.

(3.) 1836. Göppert (Prof. H. R.) **Systema Filicum Fossilium.** *Glossopteris* is described and figured.

(4.) 1845. Strzelecki (Count P. de.) **Physical Description of New South Wales and Van Diemen's Land, &c.** 8vo. London, 1845.

This was about the first attempt at a systematic classification of the rocks by their fossils. Strzelecki, however, classed the formations, which he examined, only broadly into four epochs, which, however, afterwards by the description of their enclosed fossils, have been somewhat more closely determined. The coalbeds occur in the Third Epoch, from below, and they are described from New South Wales, where they form the Newcastle Basin, and from Van Diemen's Land, where they occur especially in the Jerusalem Basin, north of Hobart.

This work of Strzelecki is very often quoted as proof of the Palaeozoic age of the Flora.

(5.) 1847. M'Coy (Prof. F.) On the Fossil Botany and Zoology of the Rocks associated with the Coal of Australia. *Ann. Mag. Nat. Hist., Vol. XX, 1 ser., pp. 145, &c., 311, &c. Plates.*

This is a most important work, because it is entirely based on thorough palæontological researches. Prof. M'Coy described fossil plants and animals.

The plants were collected at different localities, belonging, according to the present division, to different geological horizons, which, however, were then not distinguished. They are:—

Vertebraria australis, M'Coy, p. 147, Pl. IX, f. 1. Mulubimba (Newcastle).
Gleichenites odontopteroides, M'Coy, p. 147. Sandstones at Clarke's Hill*, New South Wales.
Odontopteris microphylla, M'Coy, p. 147. Clarke's Hill, New South Wales.
Otopteris ovata, M'Coy, p. 148, Pl. IX, f. 2. Arowa*, New South Wales.
Cyclopteris angustifolia, M'Coy, p. 148, Pl. IX, f. 3, 3a. Guntawang, Mudgee, New South Wales. (The present *Gangamopteris angustifolia.*)
Sphenopteris lobifolia, Morr., p. 149. Mulubimba (Newcastle).
Sphenopteris alata, Bgt., p. 149. Mulubimba (Newcastle).
Sphenopteris hastata, M'Coy, p. 149, Pl. X, f. 1, 1a. Mulubimba (Newcastle).
Sphenopteris germana, M'Coy, p. 150, Pl. X, f. 2, 2a. Mulubimba (Newcastle).
Sphenopteris plumosa, M'Coy, p. 150, Pl. X, f. 3, 3a. Mulubimba (Newcastle).
Sphenopteris flexuosa, M'Coy, p. 150, Pl. IX, f. 4, 4a.

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* See foot-note on next page.

Glossopteris Browniana, Bgt., p. 150–51. Jerry's Plains and Mulubimba.

Glossopteris linearis, M'Coy, p. 151, Pl. IX, f. 5, 5a. Wollongong and (?) Arowa*.

Pecopteris tenuifolia, M'Coy, p. 152, Pl. IX, f. 6. Clarke's Hill. (A doubtful species.)

Zeugophyllites elongatus, Morr., p. 152. Mulubimba, New South Wales.

Phyllotheca australis, Bgt., p. 156. Mulubimba, New South Wales.

Phyllotheca ramosa, M'Coy, p. 156, Pl. XI, f. 2, 3. Mulubimba, New South Wales.

Phyllotheca Hookeri, M'Coy, p. 157, Pl. XI, f. 4–7. Clarke's Hill, New South Wales.

The fossil animals do not concern us here. I shall, therefore, not enumerate them. They are quoted by the Rev. W. B. Clarke in his "Remarks on the Sedimentary Formations of New South Wales," 1878, Appendix XI B, p. 124.

(6.) **1848. Clarke (Rev. W. B.) Remarks on the identity of the Epoch of the Coal-beds and Palæozoic Rocks of New South Wales.** *Ann. Mag. Nat. Hist*, 1848, *Vol. II., p.* 206.

(7.) **1847 Jukes (Prof. J. B.) Notes on the Palæozoic Formations of New South Wales and Van Diemen's Land.** *Quart. Journ. Geol. Soc., Vol. III, p.* 224, *&c.*

(8.) **1848. Clarke (Rev. W. B.) On the Genera and Distribution of Plants in the Carboniferous System of New South Wales.** *Quart. Journ. Geol. Soc., Vol. IV., pp.* 60, *&c.*

In contradiction to Count Strzelecki's statement of the entire absence of the genera *Sigillaria*, *Calamites*, and *Lepidodendron*, in the Australian coal-beds, Mr. Clarke maintains the occurrence of them in these strata. He also names various other genera of Carboniferous plants.

(9.) **1849. Dana (Prof. J. D.) Geology: Wilkes' United States Exploring Expedition.** *Vol. X. Appendix, p.* 714. *4to. Philadelphia*, 1849.

There the following fossils are described:—

Urosthenes australis, Dana, a heterocercal fish, p. 681, &c., Pl. I, f. 1. Newcastle.

Coniferous Stems, p. 714.

---

* These two localities require some explanation:—

Clarkes' Hill is in the Wianamatta beds, and not in the Newcastle beds, where *Thinnfeldia (Gleichenites) odontopteroides* does not occur.

The position of **Arowa** was uncertain, until I have recognised, from original specimens, forwarded by Mr. W. B. Clarke, that *Otopteris ovata* was the same as *Rhacopteris* from the beds at Smith's Creek, and thus the beds at Arowa appear on the same horizon (beds below Lower Marines), but then it would appear doubtful whether *Glossopteris linearis*, quoted by M'Coy from Arowa, really came from that locality.

Coniferous Scales, p. 714.

Nöggerathia spathulata, Dana, p. 715, Pl. XII, f. 9. Illawarra district.

Nöggerathia media, Dana, p. 715, Pl. XII, f. 10. Newcastle, mouth of Hunter River.

Nöggerathia elongata (Morr.), Dana,—*Zeugophyllites*, Morris.

Sphenopteris lobifolia (Morr.), Dana, p. 715, Pl. XII, f. 12. Newcastle.

Glossopteris Browniana (Bgt.), Dana, p. 716, Pl. XII, f. 13. Newcastle, Illawarra.

Glossopteris ampla, Dana, p. 717, Pl. XIII, f. 1. Newcastle, Illawarra.

Glossopteris reticulum, Dana, p. 717, Pl. XIII, f. 2. Newcastle.

Glossopteris elongata, Dana, p. 718, Pl. XIII, f. 4. Newcastle.

Glossopteris (?) *cordata*, Dana, p. 718, Pl. XIII, f. 5. Illawarra district.

Glossopteris linearis, M'Coy, p. 718.

Phyllotheca australis (Bgt.), Dana, p. 718, Pl. XIII, f. 6. Newcastle.

Clasteria australis, Dana, p. 719, Pl. XIV, f. 3—5. This is, I believe, identical with *Vertebraria australis*. Newcastle.

Other species are rather doubtful.

Professor Dana did not trace an interpolation of the plantbeds with marine beds, and he believed that there is a break between the Palæozoic marine fossils and the plant remains. The coal beds of Newcastle he declares to be of Permian age, I suppose with regard to the heterocercal fish.

(10.) 1850. Jukes (Prof. J. B.) **Sketch of the Physical Structure of Australia.** 8vo. *London*, 1850.

(11.) 1850. Unger (Prof. F.) **Genera et Species Plantarum fossilium.** 8vo. *Leipzig*, 1850.

Therein all the fossil plants described up to that date from Australia in the above works are mentioned.

(12.) 1856. Clarke (Rev. W. B.) **Notes on the Geology of New South Wales.** *Quart. Journ. Geol. Soc., Vol. XI, p.* 408.

Here the following sequence of strata is given (downwards):—

1. Coal-bearing beds.
2. Rocks, with Lower Carboniferous or Devonian (?) fossils, coal plants, and coal.

3. Metamorphosed grits and fine conglomerates. In the Liverpool Range *Lepidodendron* was found.*
4. Strata, probably of Silurian age.

Mr. Clarke also mentions the occurrence of fossil fishes in the higher beds around Sydney,† which resemble the Permian forms.

(13.) **1856. Wilson (J. S.) Notes on the Geology of the Neighbourhood of Sydney, Newcastle, and Brisbane, Australia.** *Quart. Journ. Geol. Soc., Vol. XII, pp.* 283-288.

Lepidodendron, from Goonoo Goonoo, on the Peel River, New South Wales, is mentioned (p. 287).

(14.) **1860. Clarke (Rev. W. B.) A Communication from the Rev. W. B. Clarke, of Sydney, to His Excellency Sir Henry Barkley, K.C.B., etc., President of the Royal Society of Victoria, on Prof. M'Coy's "New Tæniopteris from the Coal-bearing Rocks of the Cape Paterson district, etc."** *Trans. Roy. Soc. Vict.,* 1860, *Vol. V, pp.* 89-95.

(15.) **1860. M'Coy (Prof. F.) A Commentary on "A Communication made by the Rev. W. B. Clarke to His Excellency Sir Henry Barkley, K.C.B., etc., etc., on Prof. M'Coy's "New Tæniopteris," etc.** *Loc. cit., pp.* 96-107.

(16.) **1860. Clarke (Rev. W. B.) Remarks on Prof. M'Coy's "Commentary," etc.** *Ibidem, pp.* 209-214.

(17.) **1860. M'Coy (Prof. F.) ote on Rev. W. B. Clarke's "Remarks," etc.** *Ibidem, pp.* 215-217.

These controversial papers contain a good deal of generally interesting matter.

(18.) **1860. Zigno (Baron A. de). Some Observations on the Flora of the Oolite.** *Quart. Journ. Geol. Soc., Vol. XVI, pp.* 110-115.

(19.) **1861. Clarke (Rev. W. B.) On the Relative Position of Certain Plants in the Coal-bearing Beds of Australia.** *Quart. Journ. Geol. Soc., Vol. XVII, pp.* 534, *etc.*

(20.) **1859. Oldham (Dr. Th.) On the Geological Relations and Probable Geological Age of the several Systems of rocks in Central India and Bengal.** *Mem. Geol. Survey, India, Vol. II, Part* 2, *pp.* 300, *et seq.*

In this paper Dr. Oldham discusses the relations of the various groups with fossil plants in India, followed by observations on the Australian coal formations.

(21.) **1863. Oldham (Dr. Th.) Additional Remarks on the Geological Relations and probable Geological Age of the several Systems of rocks in Central India and Bengal.** *Mem. Geol. Survey, India, Vol. III, Part* 1, *pp.* 197, *et seq.*

(22.) **1861. Clarke (Rev. W. B.) Recent Geological Discoveries in Australasia.** *Phil. Soc. N. S. Wales,* 1861.

In this work Mr. Clarke notices all the important discoveries with regard to the geology and palæontology of Australia during the ten years from

---

* I suppose *Lepidodendron nothum* from the Peel River.

† These were apparently from the Hawkesbury-Wianamatta beds.

1851 to 1861. There is, of course, also a great deal of the discussion about the age of the Australian coal-beds.

(23.) 1865. **Clarke (Rev. W.B.)** **On the Coal Seams near Stony Creek, West Maitland District, New South Wales.** *Trans. Roy. Soc. Victoria*, 1865, *Vol. VI., p.* 27.

Therein the Rev. Mr. Clarke has treated of the same subject, with the intention of showing that the lower beds, containing Carboniferous animals, were conformable to the higher beds, with plant fossils, and that *Glossopteris* beds were really intercalated with marine strata containing Palæozoic fossils.

(24.) 1863. **Zigno (Baron A. de)** **Sopra i depositi di piante fossili dell America settentrionale, &c.** *Padova*, 1863.

Baron de Zigno modifies in this paper his communications about the Oolitic Flora. The greater portion of the Australian plants are correlated more closely with Triasic and Liassic forms than with simply Oolitic.

(25.)* 1866. **Clarke (Rev. W. B.)** **On the Occurrence and Geological Position of the Oil-bearing Deposits in New South Wales.** *Quart. Journ. Geol. Soc.*, 1866, *Vol. XXII., pp.* 439–448.

The author gives at first a brief summary of the various divisions of the coal-bearing beds of New South Wales, as follows, in descending order:—

1. Wianamatta beds	700 to 800 feet.
2. Hawkesbury beds	800 " 1,000 "
3. Upper Coal Measures (including Nattai, Wollondilly, Illawarra, and Lower Hunter beds)	5,000 "
4. Upper Marine beds	3,000 "
5. Lower Coal-measures	1,000 "
6. Lower Marine beds (with *Lepidodendron, Sigillaria, Syringodendron, etc.*)	4,000 "
7. Porphyry or granitic rocks rising through slates	

Oil-bearing products (viz., cannel coal) have already been found in the *third* and *fifth* divisions.

(26.) 1864. **Egerton (Sir P. de M. G.)** **On some Ichthyolites from New South Wales, forwarded by the Rev. W. B. Clarke.** *Quart. Journ. Geol. Soc.*, *Vol. XX, p.* 1, *Pl. I.*

This paper contains descriptions of three species of fishes from the Wianamatta and Hawkesbury beds, viz., *Palæoniscus*, *Cleithrolepis*, and

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* The various papers to be quoted now are of greater and more positive importance than those named before, because they contain greater details about the several formations, and I would especially draw attention to them, because they will enable us to construct the general sequence of geological strata in New South Wales with regard to the plant fossils, and because from them it will be apparent which strata are to be correlated with those in the neighbouring provinces—in India and elsewhere.

Myriolepis, which have been, by several authors, ostensibly adduced as evidence for a Palæozoic facies even of the Wianamatta-Hawkesbury beds, because it was assumed that they were all heterocercal, which, however, is not quite so clear a case.

(26a.) 1869. **Clarke (Rev. W. B.)** **Remarks on the Sedimentary Formations of New South Wales.** *8vo. Sydney*, 1869.

This was written for, and published in the "Catalogue of the Natural and Industrial Products of New South Wales," and forwarded to the Paris Exhibition of 1867 by the New South Wales Exhibition Commissioners.

The same paper was reprinted at Melbourne in the "Official Record of the Intercolonial Exhibition of Australasia," and subsequently in the "American Journal of Science and Art."

A second edition appeared in 1870, when it was prepared for the "Report of the Intercolonial Exhibition at Sydney," held there that year.

A third edition was published in 1875 in connection with the "Philadelphia International Exhibition of 1876." The fourth and last appeared in 1878.

(27.) 1875. **Blanford (H. F.)** **On the Age and Correlations of the Plant-bearing Series of India and on the former existence of an Indo-Oceanic Continent.** *Quart. Journ. Geol. Soc.*, 1875, *Vol. XXXI., pp.* 519-542.

This paper refers, as the title tells, chiefly to the description and comparison of the various groups of the plant-bearing system in India. But there are also references to the Australian coal beds, especially of New South Wales. Mr. Blanford mentions the various previous papers on this subject, and takes notice also of the correlations and remarks on the age of the Indian Damuda System, brought forward by Dr. Oldham in his above-mentioned papers.

(28.) 1875. **Wilkinson (C. S.)** **On the Coal Measures of New South Wales.** *Mines and Mineral Statistics of New South Wales (New South Wales Intercolonial and Philadelphia International Exhibition*, 1875.*), pp.* 127, *et seq.* 8vo. *Sydney*, 1875.

(29.) 1875. **Mackenzie (John)** **Supplementary Report on the Coal Measures.** *Mines and Mineral Statistics of New South Wales (New South Wales Intercolonial and Philadelphia International Exhibition*, 1875.*), p.* 207. 8vo. *Sydney*, 1875.

This is a very important paper, as it contains a whole series of sections, partly through various coal seams, through entire shafts, and also across large districts.

Later, however, I received from Mr. John Mackenzie a more detailed section across the same ground in the length of 20,900 feet. The section is on a scale of 1″ = 200′, so that it is not practicable to reproduce it here; but, as the numbers of the fossiliferous beds of the section also referred to a collection of identically numbered specimens taken from the various beds, I shall describe the section in a more summary order just to show the position of the various beds from which the fossils were taken. On the whole there are twenty-six fossiliferous beds marked, beginning with No. 1 to the west, and ending with No. 26 to the east.

The section is about the following:—

WEST:—(*a*) The first 2,000 feet consist of porphyritic rocks, conglomerates, breccias, and sandstones.

(*b*) From 2,000–3,000 feet we find sandstones, with imbedded shales, the latter containing fossil plants. From here are taken fossils No. 1 and No. 2, and this at 2,800 feet and 3,000 feet respectively (*Rhacopteris*).

(*c*) From 3,000–4,000 feet there are, again sandstones and shales, and No. 3 is taken at about 3,250 feet (*Rhacopteris*).

(*d*) From 4,000–6,000 feet there is an irruption of porphyry.

(*e*) In the second half between 6,000–7,000 feet there are again, sandstones with shales, from which were taken No. 4 (at about 6,430 feet), No. 5 (at about 6,630 feet), No. 6 (at about 6,680 feet), and No. 7 (at about 6,730 feet), containing *Rhacopteris, Lepidodendron, Calamites, Knorria.*

(*f*) From 7,000–8,000 feet are sandstones, with shales, containing plant impressions.

(*g*) From 8,000–9,000 feet porphyry, sandstone, and conglomerate.

(*h*) From 9,000–10,000 feet there are again, sandstones with cherty shales, which contain plant impressions. From these are No. 8 and No. 9 (at about 9,075 feet), No. 10 (at 9,300 feet), and No. 11 (at 9,770 feet) (*Rhacopteris*).

(*i*) From 10,000–11,000 feet, sandstones with shales. No. 12 (at about 10,680 feet) is taken from there.

(*k*) From 11,000–12,000 feet are sandstones, shales, and chert, with plant impressions. Here occurred No. 13 (at about 11,125 feet), No. 14 (at about 11,560 feet), No. 15 (at about 11,925 feet) (*Rhacopteris*).

(*l*) From 12,000–13,000 feet there is, at first, a bed of porphyry; then, again, sandstones, conglomerates, and shales, with plant impressions. In these series were taken Nos. 16, 17, 18, 19 (at 12,350–12,480 feet) and Nos. 20 and 21 (at about 12,880 feet), with *Rhacopteris, Knorria, Lepidodendron.*

(*m*) Between 13,000–14,000 there are sandstones and shales. No. 22 is from there, at about 14,000 feet.

(*n*) From 14,000–15,000 feet are conglomerates, sandstones, with shales; in the latter plant impressions. Nos. 23 and 24 are from there, at about 14,825 feet.

(*o*) From 15,000–16,000 feet are quartzose rocks, shales, and sandstone.

(*p*) From 16,000–18,000 feet are sandstones, conglomerates, are quartzose rocks. No. 25 was taken fromt his bed, which contains *Knorria, Calamites,* &c.; also *Conularia, Fenestella, Productus,* &c. No. 26 is also from there, at about 17,125 feet.

(*q*) From 18,000–20,900 feet is a series of sandstones, conglomerates, porphyry, &c., without fossils.

(End of section EAST.)

(30.) 1874. **Smyth (R. Brough)** Report of Progress, Geological Survey of Victoria, No. 1. *Roy. 8vo. Melbourne,* 1874. *(Government Printer).*

At page 24 of this Report Mr. R. B. Smyth states that he found, in Tasmania, *Glossopteris Browniana* associated together with *Pecopteris* (*Alethopteris*) *australis,* one of the characteristic forms of the Jurassic coal-beds of Australia.

(31.) 1876. **Smyth (R. Brough)** Geological Sketch-map of Australia. *2nd Edition. Department of Mines. Melbourne,* 1876.

(32.) 1876. **Smyth (R. Brough)** Report of Progress, Geological Survey of Victoria, No. III. *Roy. 8vo. Melbourne,* 1876. *(Government Printer.)*

In this Report there are, with the discussion of the Geological Sketch-map of Australia, given also various remarks of general interest on the Mesozoic (so called) coal strata.

They cover an area of 17,000 square miles. The coal seams are usually in the lower strata.

In New South Wales, especially, there occur in the coal strata numerous plant impressions, upon which Professor M'Coy reported as follows:—

(*a*) Wianamatta shales and conglomerates, with *Phyllotheca Hookeri*, M'Coy.
(*b*) Sydney Sandstone, in concordant position to the former. M'Coy mentions no fossils.*
(*c*) First coal-seam below the Sydney Sandstone, with *Glossopteris Browniana*, Bgt.; *Phyllotheca Hookeri*, M'Coy.
(*d–j*) Various beds and coal-seams, with *Phyllotheca australis*, Bgt.; *Phyllotheca Hookeri*, M'Coy; *Phyllotheca ramosa*, M'Coy; *Glossopteris Browniana*, Bgt., &c.
(*k*) Grey rock above the Rix seam. This is, in descending order, the first of the Palæozoic beds with marine animal fossils.
(*l*) Sandstone and limestone above the Branxton, Greta, Stony Creek, and Anvil Creek seams.
(*m*) Lowest beds of the coal formation. Sandstone, with *Lepidodendron*.
(*n*) White chert, with *Lepidodendron*.†

(33.) 1874–1878. **M'Coy (Prof. F.)** **Prodromus of the Palæontology of Victoria (Decades I–V).** *Roy. 8vo. Melbourne*, 1874–78. (*Government Printer*).

In this work fossil plants from Victoria are described and illustrated, but there are also general remarks referring to the age and correlation of the Newcastle beds, New South Wales.

Since 1876 I myself published several papers on the Indian Flora, partly in the Records of the Geological Survey of India, and partly in the Palæontologica Indica, where I had, also, ample opportunity to refer to the Australian Flora, especially in consequence of the examination of Australian fossil plants, which, in 1875, and also subsequently, were sent to me by the late Rev. W. B. Clarke and also by Mr. C. S. Wilkinson, the Government Geologist, Sydney. In these papers I endeavoured to show that the Indian coal-beds (Damudas) were not analogous to the Australian Newcastle beds, and that they are not Palæozoic, without, however, denying even then the possibly Palæozoic age of the Newcastle beds.

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* This is the Hawkesbury Sandstone, which, however, contains some fossils.
† I suppose the beds *m* and *n* represent the Lepidodendron beds of Smith's Creek and Port Stephens.

(34.) 1876. **Feistmantel (Dr. O.)** **Notes on the Age of some Fossil Floras in India.**
Records Geol. Survey, India, Vol. IX, No. 3, 1876, pp. 63, et seq.

In this paper I wrote (p. 64) as follows:—"It is not unnatural that certain genera, having a wide range in time, should be common to several series. They can, however, be of no important influence in fixing the age, which must be determined by the other fossils with which they are associated. * * * and, similarly, there is no reason why a certain species of the genus *Glossopteris*, occurring in our Damuda series, the flora of which is really Mesozoic, should not also be found as well (and, perhaps, prevail) in some of the supposed Palæozoic coal strata of New South Wales. The Damuda group has no real connection with the lower coal beds of New South Wales, although *Glossopteris* occurs in both, and in Australia (but only in the lower strata) is associated with marine fossils of Palæozoic age."

In discussing the probable age of the Damuda formation, I wrote further (p. 68):—"(*a*) In Australia there may be fossil remains of animals which determine the age of the series, although a certain species of *Glossopteris* is found with them. (*b*) In India, on the other hand, as no fossil animals have been found, the age of the series must be determined by the other plants, notwithstanding the occurrence of *Glossopteris*, Bgt. My conclusions are the following:—That *Glossopteris*, Bgt., began to exist in the lower coal strata of Australia, where it is said to be associated with fossil animals of Carboniferous age, and continued in our Indian coal strata, which, however, are characterised by some very well-defined genera, &c."*

I also remarked (p. 71):—"We should rather say some species of *Glossopteris* are found in the supposed Palæozoic coal strata of Australia, but the genus also occurs in great abundance in the lower Mesozoic coal strata of India."

About my above remarks the Rev. W. B. Clarke, in a letter, dated Sydney, 31st December, 1876, expressed himself as follows:—"I think your view of the prior age of *Glossopteris* in Australia is the best solution I have heard of the matter."

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* When quoting this passage in my German work on the Fossil Flora of Eastern Australia, Cassel, 1879, p. 187, I appended already then the following remark:—"When I wrote the above the Karharbari beds were not yet separated from the other higher coal-beds. In the meantime they have been separated, and placed with the lowest group, the Talchir beds, and as these beds are best to be compared to the Newcastle beds, and to the Bacchus Marsh sandstones, the Indian coal-beds appear consequently higher."

The final conclusion in this paper was:—That the Panchet Group in India was Upper Triassic, while the Damudas were Lower Triassic; but I then included the Talchirs also, as the Karharbari beds were not separated at that time.

(35.) 1876. **Feistmantel (Dr. O.)** **The Gondwana Series of India as a probable representative of the Juro-Triassic Epoch in Europe.** *Geol. Mag.*, 1876, *Vol. III., p.* 481.

At about the same time as in the "Records" *(loc. cit.)* I wrote a paper in the *Geological Magazine,* wherein I pronounced the same views with regard to the correlation of the Indian and Australian coal beds. I pointed, especially, to the circumstance that in the Damuda Group *Glossopteris* is associated with Triassic forms, which do not occur in Australia at all, and, also, that, in India, *Glossopteris* is never associated with marine Palæozoic animals, which do occur in Australia. I proposed an explanation, which I thought well suitable, viz., that *Glossopteris* grew first in Australia during the Carboniferous epoch, but survived in India, passing, perhaps, through China,* when India was in connection with the European Triassic Continent.

(36.) 1876. **Feistmantel (Dr. O.)** **Notes on the Age of some Fossil Floras in India. VI: On the Homotaxis of the Gondwana System.** *Records Geol. Survey, India, Vol. IX, Part* 4, 1876, *pp.* 115, *et seq.*

In this paper I treated, especially, of the various relations of the Damuda Group, *i.e.*, the coal-bearing portion above the Talchirs and Karharbari beds.

In Chapter C, p. 121, I treated of the question—"What is the analogy of our Damuda Series with the lower coal measures in Australia?"

(37.) 1878. **Blanford (W. T.)** **The Palæontological Relations of the Gondwana System: A Reply to Dr. Feistmantel.** *Records Geol. Survey, India, Vol. XI, Part* 1, *pp.* 104–150.

(38.) 1878. **Clarke (Rev. W. B.)** **Remarks on the Sedimentary Formations of New South Wales.** *4th edition. With map and sections.* 8vo. *Sydney,* 1878. *(Government Printer.)*

In comparison with the previous editions of the same work the present one is greatly enlarged, not only in the text itself, but also by a series of very useful appendices, so that it is quite justifiable to notice it at some length here.

Mr. Clarke treats, at first, of the various formations in New South Wales in ascending order. The "Azoic" or "Metamorphic," and "Lower Palæozoic" (Lower and Upper Silurian) need of no special notice here. The

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* On this occasion I may remind of the subsequent discovery of *Glossopteris* in the coal beds of Tonkin, together with Rhætic plants. I shall mention this Flora, especially, further on.

"Middle Palæozoic" represents the Devonian. From this only a few plant fossils are known, viz., *Lepidodendron nothum*, Ung., in New South Wales (similarly in Queensland), also some other plants in Victoria. Besides, by this, the existence of Devonian rocks in New South Wales is also proved by marine animal fossils, which were described by Prof. de Koninck. (*See* p. 25.)

Of most interest is Mr. Clarke's section "Upper Palæozoic," in which he comprises the Australian coal beds, both the lower coal beds and below marine Palæozoic beds, as also the Newcastle beds, which, by M'Coy and other palæontologists, were considered of Oolitic or Jurassic age. His view of a similar age of the higher, or Newcastle, and lower coal beds, Mr. Clarke based upon the fact that certain genera of plants, which are numerous in the Newcastle beds, occur already in the lower coal beds between marine strata with Palæozoic animals. To prove this, Mr. Clarke communicates the sections of two shafts, viz., at Stony Creek and Greta, on the Hunter River, in the northern part of the field, which were also published in the previous editions of his work. They show quite distinctly how, under strata, with *Conularia*, *Spirifer*, *Productus*, &c., there are coal seams and shales with *Glossopteris*, *Nöggerathia* (now *Nöggerathiopsis*), &c.; and I myself have described several species of plants from these beds at Greta. But at the same time it is quite certain that above the Upper Marine beds there is a thick series of strata with rich coal seams and numerous plant fossils, without marine animals, but with a heterocercal fish. These are the Newcastle beds, which must be considered from this point of view. The latter relations are well illustrated in this edition of Mr. Clarke's by the geological map of a portion of the eastern coal-field of New South Wales, where the Wianamatta-Hawkesbury, upper coal beds (Newcastle beds), and marine beds are developed in regular succession—one above the other.

The division which Mr. Clarke has given of the Australian coal formation also shows quite distinctly this sequence, and clearly the position of the upper coal-beds (Newcastle beds)—above the marine strata. This is given (p. 66) as follows:—

1. Upper Coal Measures (Newcastle beds).
2. Upper Marine beds.
3. Lower Coal Measures, with *Glossopteris*, &c.
4. Lower Marine beds.

Below these latter (No. 4) there are, again, plant beds of Lower Carboniferous age (Culm.)

Above the Newcastle beds there are no more marine Palæozoic rocks, but more recent strata, viz., (in ascending order) the Hawkesbury beds and the Wianamatta beds. They contain certain plant fossils and Ganoid (partly heterocercal) fishes.

Mr. Clarke treats of these latter under "Mesozoic or Secondary Formations," but at the same time he calls them "Supra-Carboniferous" (p. 70 and Appendix XVIII) without, however, expressing a distinct view about their age, although it appears that he lays stress on the occurrence of heterocercal fishes.

Mr. Clarke reproduces my views (pp. 58–60 and pp. 75–81) about the Indian Flora and its relations with that in Australia, partly according to my published notes in the Records of the Geological Survey of India and partly from my letters written to him on this matter. One of the latter communications is printed (p. 81), and I think the contents of it even now to be fully justified, so that it is reproduced here. I wrote then:—"*Glossopteris* began to live in Australia during the time when Carboniferous animals lived in the sea—in the time of the lower Australian coal-beds. They are, therefore, of Carboniferous age. But *Glossopteris* continued to live when already the lower beds were deposited (including the marine animals), or when the marine animals ceased to live—when, therefore, in fact, another epoch of life began, which was characterised by the total absence of marine Carboniferous animals, and by the preponderance of plants; and I think in this lies the difference between your upper and lower coal beds. * * * * And for this reason I thought only those upper coal strata in your country could be compared with our Talchir-Damuda beds, as these do not contain any marine fossils at all. * * * *"

In the same paragraph Mr. Clarke also treats of the Mesozoic of Victoria, without, however, separating the Bacchus Marsh beds from the Upper Carbonaceous.

To the paper there are added twenty Appendices (I–XX), which contain various tabular views, lists of fossils, &c.

(39.) **1876-1877. Koninck (Professor L. G. de)** **Recherches sur les Fossiles paléozoiques de Nouvelle-Galles du Sud.** 2 *vols.* 8*vo. and* 4*to.* 1876-77. *Bruxelles.*

Prof. de Koninck described fossils from the Silurian, Devonian, and Carboniferous. From the latter, also, several plants are mentioned, viz., *Lepidodendron veltheimianum*, Stbg.; *Bornia radiata* (*Calamites radiatus*), Bgt.; *Calamites varians*, Germ. As far as I could understand, these fossils came from strata below the Lower Coal Measures. From the Silurian beds an alga, *Spirophyton cauda-phasiani*, Kon., is mentioned.

Prof. de Koninck, whose knowledge of Palæozoic, especially of Carboniferous fossils, is unsurpassed, assigns to the greatest portion of the fossils of the marine beds below the Newcastle coal beds an Upper Carboniferous age. This agrees very well with the age of the *Lepidodendron* beds below the lower marines, which are, as will still be shown later on, of Lower Carboniferous age, while the Newcastle beds themselves turn out naturally Permian.

(40.) **1878. Etheridge (R. Jun.)** **A Catalogue of Australian Fossils, &c.** *8vo. Cambridge*, 1878.

This is a very useful handbook, containing lists of Australian fossils known up to 1878 from the various formations.

(41.) **1878–1879. Feistmantel (Dr. O.)** **Palaeozoische und mesozoische Flora des östlichen Australiens.** *Palaeontographica, Cassel. Two parts. With* 18 *and* 12 *plates.*

The above work contains descriptions and illustrations of plant fossils, which were sent to me by the late Rev. W. B. Clarke in 1876 and 1878, supplemented by some fossils which Mr. C. S. Wilkinson, Government Geologist, placed at my disposal.

Both gentlemen made, also, various communications to me regarding the fossils and the stratigraphical relations connected with them, which I have, to a great extent, made use of in my writings.

I would point, especially, to the circumstance that, in the first part, the Lepidodendron beds (Port Stephens, Smith's Creek, Stroud) were wrongly placed above the Lower Marine Series while they belong below; in the second part (1879) the sequence of strata, in the table on pp. 190–191, are on the whole correct. At the same time I must draw attention to the many, sometimes rather serious, misprints, which were occasioned by my not being able to correct the proofs myself, because the work was printed in Germany while I was in India.

(42.) **1879–1880. Mueller (Baron F. von)** **Ottelia præterita—F. v. M.** *Journ. and Proc. Roy. Soc. N. S. Wales*, 1879, *Vol. XIII, pp.* 95–96. *Pl.* 8.

The above fossil is supposed to be from the Hawkesbury rocks of Green Bush Quarry, on the Kissing Point Road, near Parramatta, and is placed in the Hydrocharideæ.

(43.) 1880. **Feistmantel (Dr. O.)** **Notes on the Fossil Flora of Eastern Australia and Tasmania.** *Journ. and Proc. Roy. Soc. N. S. Wales,* 1880, *Vol. XIV, p.* 103.

This is an abstract of my above work. There I have already correlated the Talchir beds, Bacchus Marsh beds, and Hawkesbury beds, which correlation, however, now, with regard to the latter, is no more tenable, because the Newcastle beds have now to take the place of the Hawkesbury beds, while they, themselves, occupy a higher position analogous to that of the Damudas in India. Here, also, is to be mentioned that the Lepidodendron beds of Port Stephens and Stroud are wrongly placed above the Lower Marine Series.

(44.) 1879-1880. **Wilkinson (C. S.)** **Report of Progress of the Geological Survey during the year 1879.** *Ann. Report Depart. Mines, N. S. Wales for* 1879. [1880.], *pp.* 213-217.

Mr. Wilkinson refers to the palæontological specimens in the International Exhibition of Sydney (p. 216).

In the same work there are also given figures of ***Macrotæniopteris wianamattæ,*** Feistm. (Pl. V.), and of ***Palæoniscus antipodeus,*** Egert. (Pl. VI.), from the Gib Tunnel, Wianamatta Shales.

(45.) 1878. **Guide du Géologie à l'Exposition Universelle de 1878 et dans les Collections publiques et privées de Paris.**

There are in the chapter "Stratigraphical Geology," notes by M. Zeiller upon the age of the specimens of fossil plants from the New South Wales coal-beds sent by Mr. Wilkinson.* In these notes M. Zeiller quite distinctly pleads for the separation of the Newcastle beds from the underlying marine beds, and thinks rather that they are more closely connected with the Hawkesbury and Wianamatta beds. He, however, is inclined to consider them as of Oolitic age, which they of course are not.

(46.) 1879. **Feistmantel (Dr. O.)** **The Flora of the Talchir-Karharbari Beds. "Fossil Flora of the Gondwana System," Vol. III, part I, and Suppl. 1888.** *Palæontologica Indica, Ser. XII, Part* 1, 1879, *and Suppl.*, 1881.

In this Memoir I have, on pp. 31, 32, quite distinctly established the correlation of the Talchir-Karharbari beds with the Bacchus Marsh beds in Victoria on palæontological evidence only. The Bacchus Marsh beds I then considered as probably representative of the Newcastle beds, and the same was therefore the case with the Talchir-Karharbari beds. In the supplement to the above work (1881) I have, however, already, under the influence of the reported observation of a boulder bed[*] in the Hawkesbury beds, compared this boulder bed with that in the Talchir, and placed therefore the Newcastle beds on a lower horizon.

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* Compare "The International Congress of Geologists, Paris, 1878," by Prof. Liversidge. *Journ. and Proc. Roy. Soc. N. S. Wales,* 1879, *Vol. XIII, pp.* 39-40.

The relations of the distribution of the genus *Rhiptozamites*, Schmalh., and *Nöggerathiopsis*, Feistm., which I intended to illustrate in the tabular view in the above work (p. 57) remain, however, undisturbed.

(47.) 1879. **Wilkinson (C. S.) Notes on the Occurrence of Remarkable Boulders in the Hawkesbury Rocks.** *Journ. and Proc. Roy. Soc. N. S. Wales*, 1879, *Vol. XIII, pp.* 105–107.

(48.) 1880. **Feistmantel (Dr. O.) Further Notes on the Correlation of the Gondwana Flora with that of the Australian Coal-bearing System.** *Records Geol. Survey, India, Vol. XIII., part* 4, *pp.* 250–253.

According to the recent observations of Mr. R. D. Oldham, which I shall mention later on, the Hawkesbury boulder bed cannot be correlated with that in the Bacchus Marsh beds, this being now said to be contemporaneous with a similar boulder bed in the marine beds below the Newcastle coal beds.[†]

The tabular view in my above note (p. 253) can, however, easily be adapted to this new observation by shifting somewhat higher the sequence in the fourth (right) column, under the heading "*New South Wales,*" so that opposite the boulder bed in Victoria would be placed the marine beds, below the Newcastle beds; these themselves would stand opposite the Bacchus Marsh beds (above the boulder bed), and opposite the Talchir-

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[*] [The term "boulder bed" is, in this case, hardly applicable. The so-called "boulders" embedded in the Hawkesbury Sandstone are *angular* fragments of shale, of all sizes up to thirty feet thick, which have evidently been torn up by ice moving upon beds of shale, and mingled in an irregular manner with the drifted sand which has formed the bed of sandstone immediately overlying the shale bed. These angular boulders have not been removed far from their source; in some sections they are seen to have been piled up upon the undisturbed portions of the shale beds from which they have been derived—so that their origin is apparent. The shales are contemporaneous with the sandstones, being interstratified with them at various horizons throughout the Hawkesbury formation, in which there are also occasional beds of pebble conglomerate. The beds of sandstone containing these angular fragments of shale cannot, therefore, strictly speaking, be termed "boulder beds," or compared with the conglomeratic beds of the Lower and Upper Marine Carboniferous Series of New South Wales, or those of Bacchus Marsh in Victoria, which consist chiefly of rounded and sub-angular boulders of all sizes, some being several tons in weight, down to pebbles, sand, and earthy material, and in places form true conglomerates; in others fine sandy sediments, with the boulders and pebbles sparingly scattered through them. Some of the boulders have been drifted for a considerable distance, as they are composed of rocks not known *in situ* in the locality.

The evidence of ice action in these boulder beds is of much interest and importance, as indicative of certain physical conditions, such as those of climate, or of the transporting oceanic currents; but apart from palæontological and stratigraphical data it can only be adduced for the provisional correlation of formations in widely separated localities.—C. S. W.]

[†] [These beds are only "similar" in lithological character, viz., in the mode of occurrence in them of erratic boulders, which has led to the belief that the transporting agency of ice has been concerned in their deposition. It is doubtful, however, if this evidence alone should be considered sufficient to justify the correlation of the two formations; further examination of them is, I think, necessary. The marine fauna and boulders, scratched, it may be by ice, which have been found in the Marine Series of New South Wales, have not yet been detected in the boulder beds of Bacchus Marsh, in Victoria.- C. S. W.]

Karharbari beds in India, so that the Hawkesbury-Wianamatta beds come, naturally, opposite the Damuda-Panchet Groups.

(49.) 1881. **Feistmantel (Dr. O.)** **The Fossil Flora of the Gondwana System, Vol. III. Parts 2 and 3: The Flora of the Damuda and Panchet Divisions.** *Palæontologia Indica, Ser. XII. Parts 2 and 3.*

In the general remarks of this work (pp. 129–132) I also discussed the relations of the Indian coal flora to the Australian, especially to that of the Newcastle beds.

(50.) 1879—1880. **Hector (Dr. James)** **On the Geological Formations of New Zealand compared with those in Australia.** *Journ. and Proc. Roy. Soc. N. S. Wales, Vol. XIII,* 1879, *pp.* 65, *&c.*

(51.) 1882. **Cruttwell (Alfred)** **Note on Dr. Hector's New Zealand Geology.** *Geological Magazine,* 1882, *Vol. IX, pp.* 142–143.

(52.) 1882. **Woods (Rev. J. E. Tenison)** **The Hawkesbury Sandstone.** *Journ. and Proc. Roy. Soc. N. S. Wales,* 1882, *Vol. XVI, pp.* 53, *&c.*

(53.) 1882. **Woods (Rev. J. E. Tenison)** **A Fossil Plant Formation in Central Queensland.** *Journ. and Proc. Roy. Soc. N. S. Wales,* 1882, *Vol. XVI., pp.* 179, *&c.*

I shall quote this paper once more, when the formations of Queensland will be described, but I refer to it here because Mr. Tenison Woods gave (p. 189) a sequence of the plant-bearing rocks in other parts of Australia also. The author describes fossils of the same age as those from Port Stephens and Smith's Creek, near Stroud, in New South Wales, and which were not hitherto known, from Queensland; they come from near Bobuntungen,* in the Drummond Range.

(54.) 1883. **Woods (Rev. J. E. Tenison)** **On the Wianamatta Shales.** *Journ. and Proc. Roy. Soc. N. S. Wales,* 1883, *Vol. XVII, pp.* 75, *&c.*

(55.) 1883 **Woods (Rev. J. E. Tenison)** **On the Fossil Flora of the Coal Deposits of Australia.** *Proc. Linn. Soc. N. S. Wales,* 1883, *Vol. VIII, Part* 1, *pp.* 35-167, 11 *Plates.*

This is an extensive Memoir, written especially with the intention to enlarge and complete my own publications on the Australian Flora, and to place within the reach of Australian students not only what relates to Australian coal plants but also a general view of their scientific classification.

Mr. Tenison Woods has given a classification of the Australian plant-bearing strata (pp. 51–58), which, however, is not, I think, in all its points quite correct.

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* This is as Tenison Woods writes it; on the map, attached to the "Catalogue of Exhibits," 1886, (London), I find written—Bogantungen.

(56.) 1884. **Stephens (T.)** **Notes on Boring Operations in Search of Coal in Tasmania.** *Papers and Proc. Roy. Soc., Tasmania, for* 1884, [1885] *p*, 47.

I quote this paper here because it also contains a list of the formations in New South Wales, with the indication of their age.

(57.) 1885. **Johnston (R. M.)** **Geological Table showing the proposed provisional Classification of Stratified Rocks for Tasmania, &c.** *Papers and Proc. Roy. Soc., Tasmania, for* 1885, [1886].

(58.) 1884—1885. **Blanford (W. T.)** **Address to the Geological Section of the British Association, Montreal, 1884. Also reprinted under the title, "Homotaxis, as illustrated from Indian Formations."** *Records Geol. Survey India*, 1885, *Vol. XIX, Part* 1, *p*. 32.

The paper is one of general bearing, referring also to Australian and African formations.

(59.) 1886. **Oldham (R. D.)** **Memorandum on the Correlation of the Indian and Australian Coal-bearing Beds.** *Records Geol. Survey India, Vol. XIX, Part* 1, *pp*. 39–47.

There is a great deal of important matter in this paper. It refers both to Victoria and New South Wales, but also to India. The most important portion is the information about the conglomerates, supposed to have been formed by ice action, in the beds below the Newcastle beds.

Mr. C. S. Wilkinson wrote to me a letter, dated Sydney, 29th September, 1886, about the mentioned discovery, as follows:—"In the marine conglomerate, *above* the Greta seam of the Lower Coal Measures, my Assistant, Mr. T. W. E. David, and Mr. R. D. Oldham, of India (when he was over here), have found glacial evidences in the form of ice-scratched boulders."

(60.) 1886. **Oldham (R. D.)** **On Homotaxis and Contemporaneity.** *Geological Magazine*, 1886, *Vol. III, No.* 7, *pp*. 293–300.

In this essay Mr. Oldham summarises the above.

(61.) 1886. **Waagen (Dr. W.)** **Notes on some Palæozoic Fossils collected by Dr. H. Warth, in the Olive Group of the Salt Range.** *Records Geol. Survey India, Vol. XIX, Part* 1, *pp*. 22–38.

The chief results of this paper refer to India. It went to show that a certain boulder bed in the Salt Range, at the base of the so-called Olive Group, and hitherto considered Cretaceous, according to some recently-discovered pebbles containing Palæozoic fossils, had to be considered of Palæozoic age. The mode of formation of this boulder bed recalled very strongly the boulder bed of the Talchirs, at the base of the Gondwana System, which, therefore, would also be of Palæozoic age.

With regard to Australia there are a few remarks (p. 35). The Salt Range boulder bed contained such marine Palæozoic fossils as are according to Dr. Waagen, found in the marine beds* below the Newcastle coal beds, and thus the same correlation would also refer to the Talchir conglomerate. This would be, therefore, about the same correlation as Mr. Oldham, in his above paper, established for the marine beds and the Bacchus Marsh conglomerate, and through this with the Talchir boulder beds. But it was not until this year (1887) that the above relations in the Salt Range were fully established, as I shall show hereafter.

(62.) **1886. Blanford (W. T.) On Additional Evidence of the Occurrence of Glacial Conditions in the Palæozoic Era, and on the Geological Age of the Beds containing Plants of the Mesozoic Type in India and Australia.** *Quart. Journ. Geol. Soc.*, 1886, *Vol. XLII, pp.* 249, *&c.*

This paper has been written especially in consequence of the various discoveries made since Mr. Blanford had an opportunity to deliver his address before the British Association.

I shall refer to the comparative table (p. 249) only; Mr. Blanford correlates as follows:—

South Africa.	India.	Australia.
Stormberg beds	Upper Gondwanas (various groups).	Upper plant beds of Queensland, &c.
Beaufort	Panchet	Wianamatta and Hawkesbury (glacial).
Koonap	Damuda	Newcastle.
	Karharbari	Upper Marine beds (glacial).
Ecca (glacial)	Talchir	Stony Creek beds. Lower Marine beds (glacial).

This correlation is, as can be guessed from the foregoing, not quite correct. I may at once remind of the circumstance that the Panchet and Damuda form *one* series, and the Karharbari and Talchir beds another, so that the real correlation would be: Panchet-Damuda = Wianamatta-Hawkesbury; and Karharbari-Talchir = Newcastle-Marine beds; and in the same way it is with Africa.

Besides this, I would point to one circumstance especially. Mr. Blanford writes (p. 253):—"The Australian marine Carboniferous beds have usually been considered of Mountain Limestone age; but I learn from Dr. Waagen, who has made a special study of the Carboniferous fauna, in connection with his descriptions of that found in the Salt Range of the Punjab, that the Australian marine Carboniferous fossils are of somewhat later date, corresponding approximately to the Coal-measures of Western Europe."

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* Dr. Waagen used the expression of Mr. Blanford, saying, "Lower Coal Measures with marine layers interstratified," which, as I mentioned before, is not correct.

(63.) 1887. **Neumayr (Prof. M.)** **Review of Dr. Waagen's [No. 61] and Mr. Oldham's [Nos. 59-60] Papers.** *Verhandl. K. K. Geol. Reichsanstalt,* 1887, *No.* 6, *pp.* 158–160.

(64.) 1886. **Wilkinson (C. S.)** **Collection of Minerals and Rock-specimens, arranged under the direction of C. S. Wilkinson, F.G.S., &c., by J. E. Carne, Curator of Mining and Geological Museum.** *Official Catalogue of Exhibits in New South Wales Court, Colonial and Indian Exhibition, London,* 1886, *pp.* 128 *and* 153.

(65.) 1886. **Wilkinson (C. S.)** **Collection of Characteristic Fossils from the principal Sedimentary Formations of New South Wales. Arranged by J. E. Carne, Curator of Mining and Geological Museum, under the direction of C. S. Wilkinson, F.G.S., &c.** *Official Catalogue of Exhibits in New South Wales Court, Colonial and Indian Exhibition, London,* 1886, *pp.* 158–168.

(66.) 1886. **Wilkinson (C. S.)** **Communication about the Discovery of a Labyrinthodont Amphibian in the Hawkesbury Rocks.**

In a letter dated 29th September, 1886, Mr. C. S. Wilkinson informed me about the discovery of important Amphibian remains in the Hawkesbury rocks, which decided their Triassic age. A notice on the same subject was also contained in a Report to the Under Secretary for Mines, by Mr. C. S. Wilkinson, Government Geologist. The Report was as follows:—"Department of Mines, Geological Survey Branch, 10th September, 1886. Memorandum: A few weeks ago Mr. J. H. Maiden forwarded me a large fossil shell of the genus *Planorbis*, that had been found in the excavation for the new Government docks at Cockatoo Island. This being the first fossil shell found in the Hawkesbury formation, I took the opportunity of examining the rocks with Mr. L. Samuel, who is constructing the docks, and only obtained some fossil plants. But as the rocks looked very promising for the occurrence of fossil remains, I sent the collector, Mr. Cullen, to make further search, and he was rewarded by the discovery of a most interesting fossil, which Professor W. J. Stephens has identified as *Mastodonsaurus*, of which a similar specimen, from Stuttgart, is in the collection of the Sydney University. This being the first discovery in Australia of the *Labyrinthodon*, a gigantic amphibian, is of much scientific importance, as proving the Triassic age of the Hawkesbury Sandstone formation.—(*Signed*) C. S. Wilkinson, G.G."

(67.) 1876. **Stephens (Prof. W. J.)** **Notes on a Labyrinthodont Fossil from Cockatoo Island, Port Jackson.** *Proc. Linn. Soc. N. S. Wales, 2nd ser., Vol. I, Part* 3, *pp.* 931, *et seq.*

(68.) 1887. **Stephens (Prof. W. J.)** **On the Biloela Labyrinthodont.** *Proc. Linn. Soc. N. S. Wales, 2nd ser., Vol. I, Part* 4, 1887, *pp.* 1113–1121, *Plate XIV.*

In the second of these papers there are also important general remarks on the Hawkesbury-Wianamatta beds and their relation to the underlying strata.

(69.) 1887. **Stephens (Prof. W. J.)** **On some Additional Labyrinthodont Fossils from the Hawkesbury Sandstones of New South Wales.** *Proc. Linn. Soc. N. S. Wales, 2nd ser., Vol. I, pt.* 4, 1887, *pp.* 1175, *&c., Plate XXII.*

(70.) 1887. **Ratte (F.)** **Note on two New Fossil Plants from the Wianamatta Shales.** *Proc. Linn. Soc. N. S. Wales, 2nd ser., Vol. I, pt.* 4, *pp.* 1078–1084, *Plates XVI and XVII.*

(71.) 1886. **Feistmantel (Dr. O.)** **The Fossil Flora of some of the Coal-fields in Western Bengal.** *Palæontologica Indica, Ser. XII (The Fossil Flora of the Gondwana System, Vol. IV,* 2*), pp* 25 *and* 72. 14 *Plates. Calcutta,* 1886.

The second part of Vol. IV of the Gondwana Flora contains descriptions and illustrations of various interesting plants from several coal-fields in Western Bengal, which I had collected during my geological excursions in 1881 and 1882–83. As this part forms the conclusion of my Gondwana Flora, I have found it profitable to add, also, several chapters of general contents referring to the previous Lower Gondwanas.

In the introduction to the entire Vol. IV, but which is published with this second part, I noticed, also, several publications, which appeared since I left India in 1883, and which treated of the coal and plant-bearing beds in India, as well as in other parts of Asia, Australia, and Africa; and at the end of this introduction I have given a comparative table of the various strata in various countries, which appeared to me to represent best our present knowledge of the various relations.

(72.) 1887. **Feistmantel (Dr. O.)** **Uber die pflanzen und Kohlen-führenden Schichten in Indien (beziehungsweise Asien), Afrika, und Australien, und darin vorkommende glaciale Erscheinungen.** *Sitzungsberichte der K. böhm. Gesellsch. der Wissenchaften,* 1887, *pp.* 1–102.

It was my intention to show in this paper how, according to the latest literature (up to 1886), the various coal and plant-bearing beds in the above mentioned countries are to be correlated.

There is, at first, a pretty detailed sketch of the Indian Gondwana System with its fossils. Mention is made of the discovery, in 1885, of peculiar nodules in a certain conglomerate in the Salt Range in India, by which occurrence this conglomerate was pronounced to be of Palæozoic age, although up to that time it was considered to be, probably Cretaceous. But, in its physical aspect, the conglomerate of the Salt Range agreed with a similar conglomerate, or boulder bed, in the Talchirs, the basal group of the Gondwana System, and thus this also was declared to be of Palæozoic (Upper Carboniferous) age. By a subsequent inspection on the spot, by Mr. R. D. Oldham, the above observations could not be verified, so that I did not feel justified in accepting the Salt Range conglomerate as a proof of the Palæozoic age of the Talchir boulder bed, and I was, therefore, forced to look out for other evidence.

I turned first to Africa, where the Karoo formation, with the underlying Dwyka Conglomerate, is an analogous formation to our Gondwana System. As in Africa, this conglomerate is underlaid by strata, containing fossil plants of Upper Carboniferous age, I thought it natural that it could not be older than this; that the beds immediately above it (the so-called Upper Ekka beds) might be Permian, the Karoo formation proper Triassic, and so on. Both the Talchir and Dwyka Conglomerate are considered to have been formed by the action of floating ice.

With regard to Australia, important observations have been lately made also.

There is no doubt that the Bacchus Marsh conglomerate in Victoria, which also shows unmistakable signs of ice action in its formation, is contemporaneous with, or, at least, analogous with, the mentioned conglomerates in the Talchirs in India, and at the base of the Karoo formation (Dwyka Conglomerate) in South Africa. The next lower beds in Victoria are the Avon Sandstones of Lower Carboniferous age.

In New South Wales the relations are somewhat different. Up to 1885 the conglomerate* in the Hawkesbury rocks was believed to be the equivalent of that in the Bacchus Marsh beds and in the Talchir Group, the more so, as it also showed signs of having been brought together by drift ice. More recent observations (1885) have, however, shown that in the marine beds below the Newcastle Coal Measures there is another conglomerate which is to be correlated with that in the Bacchus Marsh beds, and, consequently, also with that in the Talchir Group of India, while the conglomerate of the Hawkesbury rocks is of later date. These observations placed, therefore, the beforementioned conglomerates in Victoria, New South Wales, Africa, and India in the Upper Carboniferous Epoch, and they were all, it appears formed by the action of floating ice. By this circumstance the age of the next higher beds of the series was approximately indicated.

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* [See note on p. 28—C.S.W.

I have, besides the above, included for comparison also the coal-bearing beds of Tonkin and the various formations between Carboniferous and Cretaceous in Western Afghanistan, Khorassan, and Turkistan.

(73.) **1887. Feistmantel (Dr. O.)** **Nachtrag zu meiner Abhandlung "Uber die pflanzen- und Kohlenführenden Schichten, &c."** *Prag,* 1887. *(Supplement to the above work.)*

Shortly after the publication of my above paper I received the second number of "Records of the Geological Survey of India for 1887," where there is a report by Dr. Warth on his investigations in the western part of the Salt Range, which have proved that the boulder bed in the eastern portion of the Salt Range below the Olive Group (Cretaceous) is the same as in the western portion, and that the whole of them are Palæozoic. This conglomerate also shows signs of ice action, and it will, therefore, have to be correlated with the Talchir boulder bed. It is also analogous to the conglomerates in the marine beds[*] below the Newcastle Coal Measures, to the conglomerates in the Bacchus Marsh beds, and, consequently, also to the Dwyka Conglomerate.

(74.) **1884. Murray (R. A. F.)** **The Carbonaceous Rocks of Victoria.** *Report of Progress, Geol. Survey Victoria, Vol. VII, pp.* 78, *et seq.*

On page 79 of this Report there is a comparative table of the various beds in Victoria and New South Wales.

(75.) **1885. Curran (Rev. J. Milne).** **On some Fossil Plants from Dubbo, New South Wales.** *Proc. Linn. Soc. N. S. Wales,* 1885, *Vol. IX, pp.* 250–254. 1 *Plate.*

From the Hawkesbury Sandstone, at Dubbo, the following species were determined by Mr. Tenison Woods:—*Sphenopteris crebra,* T.-W.; *S. glossophylla,* T.-W.; *Neuropteris australis,* T.-W.; *Thinnfeldia odontopteroides,* Morr., sp.; *Thinnfeldia media,* T.-W.; *Alethopteris Currani,* T.-W.; *A. concinna,* T.-W.; *Merianopteris major,* Feistm.; *Walchia Milneana,* T.-W. The later additions by Mr. Curran are:—*Odontopteris macrophylla,* T.-W.; *Alethopteris australis,* Morris, sp.; *Hymenophyllites dubia,* T.-W.[†]

In my list of localities these fossils are quoted under Ballinore Coalfield and Talbragar Mines.

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[*] [See note on p. 28—C.S.W.]

[†] [Mr. Curran also mentions *Podozamites,* sp., and *Walchia piniformis,* Sternberg (?)—R.E., jnr.]

Summary Review of the Plant-bearing Strata in New South Wales and their Age.

From the foregoing literary sources on New South Wales we may construct the following series of rocks in which plant fossils are found. I shall observe here the ascending order, because in this way it will be easier to fix with probability the age of the various rocks. I shall also enumerate with each division the hitherto described fossil plants, as well as the fresh-water or land animals. We have, thus, in ascending order:—

1. **Silurian Beds,** containing Silurian marine animals, but also, according to Prof. de Koninck's quotation, a plant, *Sphirophyton cauda-phasiani*, from Duntroon. Age—Silurian.

2. **Goonoo Goonoo Beds** (also Mount Lambie and Murrumbidgee Series), containing marine Devonian animals at Mount Lambie, near Bowenfels, and on the Murrumbidgee River. These fossils have been described by Prof. de Koninck (No. 39), and are enumerated in Appendix XV of Mr. W. B. Clarke's work (No. 38). But there are also plants from these strata, viz., *Lepidodendron nothum*, Ung., Goonoo Goonoo, Back Creek Diggings, &c.; *Cyclostigma*, sp., Goonoo Goonoo.

The localities are:—Cowra and Canowindra, on the Lachlan River; Mount Lambie, near Bowenfels; Goonoo Goonoo, on the Peel River; the Back Creek Diggings, on the Barrington River.

In 1876 and 1877 Mr. Clarke, as I shall mention again, discovered the *Lepidodendron nothum*, at Mount Lambie, *in situ*, below the level of the Brachiopod sandstone of the same locality, thus proving that it belonged to the same Devonian Series, which fact was doubted by some authors.* Age—Upper Devonian.

3. **Lepidodendron Beds,** at several localities, especially to the north of the Hunter River, in the Newcastle Coal-field, viz.:—Port Stephens, Smith's Creek near Stroud, Rouchel River, Arowa. The fossils are:—

Calamites radiatus, Bgt. Smith's Creek, near Stroud.
,, *varians*, Germ. (quoted by De Koninck).
Sphenophyllum, sp. Port Stephens.

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* [The passage referred to here, in Mr. Clarke's "Sedimentary Formations of New South Wales," is on the first reading a somewhat misleading one. The expression "below the level" must not be taken in a stratigraphical sense, but simply as indicating a lower position as regards the conformation of the ground. The Government Geologist distinctly wishes it to be understood that the *Lepidodendron* in question occurs in beds *above* the Brachiopod sandstone of Mount Lambie, he having been present with the late Rev. Mr. Clarke when the observations were made—a fact which very much weakens Dr. Feistmantel's argument.—R.E., jnr.

Archæopteris Wilkinsoni, Feistm. Smith's Creek.
Rhacopteris inæquilatera, Feistm. Smith's Creek; Port Stephens; Arowa.
Rhacopteris intermedia, Feistm. Port Stephens.
„ comp. *Römeri*, Feistm. Smith's Creek.
„ *septentrionalis*, Feistm. Smith's Creek.
Glossopteris linearis, M'Coy.*
Lepidodendron Veltheimianum, Stbg. Smith's Creek.
„ *Volkmannianum*, Stbg. Smith's Creek.
„ *dichotomum*, Stbg. Rouchel River.
Cyclostigma australe, Feistm. Smith's Creek.
Knorria state of *Lepidodendron Veltheimianum*, Stbg. Smith's Creek,
Age—Lower Carboniferous.

4. **Series of Marine Beds,** with inlaid coal measures. This series consists of three groups:—

a, **Lower Marine Beds**—containing marine animals.
b, **Lower Coal Measures**—with plants, at Greta, Anvil Creek, Stony Creek, Raymond Terrace, &c. The plant-fossils are—
Phyllotheca australis, M'Coy. Various localities.
Annularia australis, Feistm. Greta.
Glossopteris Browniana, var. *præcursor*, Feistm. Stony Creek.
„ „ Bgt. Greta.
„ *elegans*, Feistm. Greta.
„ *primæva*, Feistm. Greta.
„ *Clarkei*, Feistm. Rix's Creek.
Nöggerathiopsis prisca, Feistm. Greta.
c, **Upper Marine Beds**—with marine animals.

It is in these marine beds that Mr. R. D. Oldham (see No. 59) discovered striated pebbles in those peculiar conglomeratic beds, the accumulation of which cannot be accounted for except by the action of ice floating in large masses. These conglomeratic beds are then strictly comparable with those of Bacchus Marsh (to be mentioned hereafter), and not, as hitherto supposed by me, the conglomerates at the base of the Hawkesbury rocks.

I have also under No. 59 quoted Mr. Wilkinson's letter, dated Sydney, 29th September, 1886, where reference is made to the above discovery.

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* This is quoted from Arowa, but it appears doubtful whether it really occurs there with *Rhacopteri inæquilatera* = *Otopteris ovata*, M'Coy.

The marine animals of these strata were described by Prof. de Koninck in his work quoted above (No. 39), and it was shown that the greater part of the fossils indicated an Upper Carboniferous age. The age of the included plant beds and coal measures is therefore fixed by the age of the underlying and overlying marine beds, notwithstanding the occurrence there of various species of *Glossopteris* and *Nöggerathiopsis*, which are hereafter very numerous in higher beds. Here, therefore, is the first appearance of *Glossopteris* in great numbers (abstracting the doubtful occurrence of *Glossopteris linearis* at Arowa). Age—Middle and Upper Carboniferous.

5. The Newcastle Beds, or Upper Coal Measures.

By all authors, and especially by Mr. W. B. Clarke himself, these Upper Coal Measures are distinctly placed above the Upper Marine beds, from which point of view also their age must be judged. The fossils they contain are to the greatest extent plant remains, but fish remains were also found, representing, however, only one species.

The chief localities are: Newcastle, Blackman's Swamp, Bowenfels, Guntawang near Mudgee, Mulubimba,* Illawarra, Wollongong, &c.†

Their fossils are—

Urosthenes australis, Dana; a heterocercal fish. Newcastle.
Phyllotheca australis, Bgt. Newcastle (Mulubimba).
Vertebraria australis, M'Coy. Newcastle (Mulubimba); Bowenfels.
Sphenopteris lobifolia, Morr. Newcastle (Mulubimba).
„ *alata*, Bgt. sp. Hawkesbury River; Mulubimba.
„ *alata*, var. *exilis*, Morr. Newcastle basin.
„ *hastata*, M'Coy. Mulubimba.
„ *germana*, M'Coy. Mulubimba.
„ *plumosa*, M'Coy. Mulubimba.
„ *flexuosa*, M'Coy. Mulubimba.
Glossopteris Browniana, Bgt. Newcastle (Mulubimba); Illawarra; Blackman's Swamp; Bowenfels, &c.
Glossopteris linearis, M'Coy. Newcastle; Wollongong; Illawarra.
„ *ampla*, Dana. Newcastle.
„ *reticulum*, Dana. Newcastle.
„ *elongata*, Dana. Newcastle.
„ *cordata*, Dana. Illawarra.

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* Mr. Tenison-Woods, in his work on the Australian Coal flora (No. 55), writes, p. 53, I think for the same locality, *Mulimbula*, although further in the text he also uses Mulubimba.

† [The only locality here mentioned within the Upper Coal-measures, or Newcastle group, is Newcastle itself, the aboriginal name of which was Mulumbimba. Blackman's Swamp, Bowenfels, Illawarra, and Wollongong are now believed by the Government Geologist to be localities of the Lower Coal Measures. The position of the Guntawang deposit is at present uncertain.—R. E., jun.]

Glossopteris tæniopteroides, Feistm. Blackman's Swamp.
„ *Wilkinsoni,* Feistm. Blackman's Swamp.
„ *parallela,* Feistm. Bowenfels.
„ *densinervis,* n. sp. Bowenfels.
„ *gangamopteroides,* n. sp. Bowenfels.
„ *spathulato-cordata,* n. sp. Newcastle; Bowenfels.
Gangamopteris angustifolia, M'Coy. Guntawang, near Mudgee.
„ *Clarkeana,* Feistm. Bowenfels.
Gangamopteris, M'Coy; no species named. Leaves of these genus were quoted by Mr. Clarke in his paper on the Oil-bearing Deposits of New South Wales (No. 25), from the Nattai River and from Reedy Creek.
Caulopteris (?) *Adamsi,* Feistm. Newcastle.
Zeugophyllites elongatus, Morr. Mulubimba (probably a *Podozamites*). Quoted only as doubtful from these rocks on account of Prof. J. D. Dana's identifying it with his *Nöggerathia elongata,* which, however, appears to be different.
Nöggerathiopsis spathulata, Dana, sp. Illawarra.
„ *media,* Dana, sp. Newcastle.
Brachyphyllum australe, Feistm.
Squamæ (?) *cycadearum vel* (?) *coniferarum.* Newcastle. Age—Permian.

6. Hawkesbury and **Wianamatta Beds.**—These beds overlie the Newcastle Coal Measures. By the Rev. Mr. Clarke these two sets were considered as quite distinct. From palæontological reasons it appeared to me that these two groups, though in superposition, are very closely connected (See No. 43.).* Later on Mr. Tenison Woods tried to establish this close relation on stratigraphical grounds, and this to such a degree that he proposed to discontinue the name Wianamatta beds altogether (See No. 54.). In the most recent writings of Mr. Wilkinson, Prof. Stephens, Mr. Ratte, &c., the Wianamatta beds are, however, again spoken of as distinct in their position above the Hawkesbury rocks, and as such we must therefore consider them, but still maintaining the close palæontological connection of both.

The age of these beds seems now to be pretty well settled. At first there is their geological position; they overlie the Newcastle beds, but which, as appears from some sections observed by Mr. Wilkinson and Prof. Stephens

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* [Mr. Clarke's phraseology on this point in the last edition of the "Sedimentary Formations of New South Wales," p. 72, is rather indefinite. He refers to a "partial or general erosion before the whole series of the Wianamatta strata were laid down," but on the next page he speaks of the same genera of fish "that we find ranging from the Wianamatta down to the Coal-measures of Newcastle." We have every reason to believe, therefore, that although Mr. Clarke acknowledged a partial physical break between the two groups of beds, he still regarded them as palæontologically united.—R. E., Jnr.]

(see No. 67, p. 1114), were denuded before the commencement of the deposition of the Hawkesbury rocks, so that an interval of some length is here indicated. But the fossils also combine with the above relations to show that the age of the Hawkesbury-Wianamatta beds is more recent than that of the Newcastle Coal Measures; I refer here especially to the papers under Nos. 64, 65, 66, 67, 68, 69, and 70.

In his last work in 1878 (No. 38), Mr. Clarke treated of the Hawkesbury-Wianamatta beds under the heading "Mesozoic or Secondary Formations" (pp. 68–73), while in Appendix XVIII (p. 155) he calls them "Supra-carboniferous."

Taking all the present evidence into due consideration, there can, I think, be no reasonable objection against their being considered to belong to the Mesozoic Period.

The fossils of both these groups are:—

	Hawkesbury.	Wianamatta.
Labyrinthodont fossil (*Mastodonsaurus?*).	Cockatoo Island, Port Jackson.	
Labyrinthodont (?) remains, Stephens	....	Bowral.
Platyceps Wilkinsoni, Stephens	Gosford, Brisbane Water.	
Palæoniscus antipodeus, Egert	Gosford, Brisbane Water	Parramatta.
Cleithrolepis granulatus, Egert	Gosford, Brisbane Water; Cockatoo Island.	
Myriolepis Clarkei, Egert	Cockatoo Island.	
Phyllotheca Hookeri, M'Coy	....	Clarke's Hill, near Cobbity.
" *concinna*, T.-Woods	Sugarloaf Hill.	
Sphenopteris crebra, T.-Woods	Talbragar River.	
" *glossophylla*, T.-Woods	Talbragar Mines, near Dubbo.	
Neuropteris australis, T.-Woods	Gravel of the Bell River, near Wellington.	
Thinnfeldia odontopteroides, Morr., sp.	Mount Victoria	" "
" *media*, T.-Woods	Dubbo.	
Gleichenia dubia, Feistm.		
Odontoperis microphylla, M'Coy	....	Clarke's Hill.
Pecopteris tenuifolia, M'Coy	....	"
Alethopteris australis, Morr., sp.	Quoted by Tenison Woods (No. 54)	Quoted by Tenison Woods (No. 54).
" *Currani*, T.-Woods	Talbragar (T. Woods, No. 54).	
Merianopteris major, Feistm	Talbragar River.	
Macrotæniopteris wianamattæ, Feistm.	Mt. Victoria (according to Tenison Woods, No. 54).	Kenny's Hill.
Cycadopteris (?) *scolopendrina*, Ratte.		
Jeanpaulia palmata, Ratte.		
Podozamites distans, Presl.	Woolloomooloo Bay	South Creek.
Walchia Milneana, T.-Woods	Talbragar River.	

Age—Mesozoic-Triassic, and perhaps partly Lower Jurassic.

7. Clarence River Series.—These are described by Mr. C. S. Wilkinson (No. 28), as follows:—

"In the northern district of the Colony, on the Clarence River, occurs a series of coal-bearing shales, conglomerates. and sandstones, containing fossil plants allied to *Tæniopteris* and *Pecopteris*, supposed to be of Mesozoic age. These beds have been described as being a long way above the Newcastle *Glossopteris* beds, and to have little in common with them. They belong to a different series which may eventually be collated with the Mesozoic coal strata of Victoria.*

This appears from the fossils to be really the case. From specimens which Mr. Clarke had sent me I could determine the following fossils:—

Tæniopteris Daintreei, M'Coy (the true species as described by M'Coy). Southgate, Clarence River.

Alethopteris australis, Morris. Southgate, Clarence River.

It appears that these represent the Carbonaceous or higher Mesozoic beds of Queensland and Victoria. Age—Mesozoic-Jurassic.

Tabular view of the formations with plants in New South Wales compared with those in Europe:—

Australia: New South Wales.	Europe.
1. Clarence River Series.	Mesozoic: Jurassic.
2. Wianamatta-Hawkesbury beds (conglomerates in the latter).	Mesozoic: Lower Jura and Trias.
3. Newcastle or Upper Coal Measures (Glossopteris beds).	Palæozoic { Permian: Upper and Middle Carboniferous.
4. Series of Marine beds:— (*a*) Upper Marine beds. (*b*) Lower Coal Measures. (*c*) Lower Marine beds. (Conglomerates, showing glacial action.)	
5. Lepidodendron beds.	Palæozoic: Lower Carboniferous.
6. Goonoo Goonoo beds.	Palæozoic: Devonian.

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* [During a recent examination (in April, 1889) of the Clarence River District, I discovered that its coal-bearing series, containing *Tæniopteris* and *Alethopteris australis*, is overlaid by beds of sandstone about 400 feet thick, identical with the Hawkesbury formation, which latter has been finally determined, upon the evidence of its fossil fauna, Labyrinthodons, *Palæoniscus*, &c., to be of Triassic age. (See Clarke's "Sedimentary Formations, N. S. Wales," 4th edition, p. 69.) It is not improbable, therefore, that the Victorian "Carbonaceous Series," which, on account of their characteristic fossils *Tæniopteris Daintreei* and *Alethopteris australis*, have hitherto been considered of Jurassic age, may be the equivalents of the Clarence Series as here suggested by Professor Feistmantel, and may also possibly be of Triassic age.—C. S. W.]

VICTORIA.

In Victoria the series of plant-bearing beds is not as complete and so rich in fossils as in New South Wales, though there are, on the other hand, enough interesting relations, especially with regard to the correlation of the various beds in the provinces.

I shall at first quote the necessary literature, so as to be able to construct properly the sequence of the strata.

Literary Review.

(1.) 1860. Selwyn (A. R. C.) Notes on the Geology of Victoria. *Quart. Journ. Geol. Soc., Vol. XVI, pp.* 145, *&c.*

We read respecting the coal-beds (p. 147) :—"I have not yet been able to obtain more satisfactory evidence respecting the probable age of our coal-bearing rocks; if the mass of them be Oolitic there are certainly others in the eastern districts of the Colony which contain true Carboniferous plants."

(2.) 1862. M'Coy (Prof. F.) Notes on the Ancient and Recent Natural History of Victoria. *Ann. Mag. Nat. Hist., Vol. IX, 3rd Ser., pp.* 137-150.

This paper contains a discussion of the various rock groups in Victoria. From the Upper Palæozoic strata he mentions a *Lepidodendron,* which sufficiently establishes the Palæozoic character of these beds.

(3.) 1868. M'Coy (Prof. F.) Palæontology of Victoria. *Ann. Mag. Nat. Hist., Vol.* xx, *pp.* 109-202.

The coal-bearing rocks of Victoria are here described as Mesozoic; but in Gippsland, on the Avon River, where *Lepidodendron* was found, there the older coal formation may be represented.

(4.) 1866. Selwyn (A. R. C.) and Ulrich (G. H. F.) Notes on the Physical Geography and Mineralogy of Victora. *International Exhibition Essays,* 1866. *8vo. Melbourne,* 1866.

There is a clear distinction made between certain beds of the Bacchus Marsh Series (with ferns) and those on the Avon River with *Lepidodendron.* Selwyn writes (p. 16) :—"Mount Tambo, Avon River (Gippsland), Mansfield, and Bacchus Marsh are the only localities where fossil plants have yet been found; and in two only of these, Avon River and Bacchus Marsh, are the specimens sufficiently perfect to be clearly identified; from the former Lepidodendron, and from the latter Cyclopteris, or Gangamopteris longifolius (M'Coy)—the former certainly palæozoic, and the latter probably triassic or lower mesozoic." Selwyn also describes, from several localities, a peculiar conglomerate, which by its characters strongly reminds us of a similar one in the Talchir Group in India. He writes (p. 15) :—" In several of the localities above enumerated thick masses of conglomerate are associated with the sandstone. They occur generally towards the base of the series, and are composed of a very irregular aggregation of rounded pebbles and occasionally angular or subangular fragments of all sizes of granite, greenstone, or diorite, various porphyries, hard slate, gritty-sandstone, grey quartz-rock, and quartz. These pebbles or fragments are embedded either in a soft sometimes earthy mass, showing little or no trace of stratification as at Darley, near Bacchus Marsh, &c." He writes further (p. 16) :—" The character of the conglomerate beds before mentioned, near Darley and on the Wild Duck Creek, is such as almost to preclude the supposition of their being due to purely aqueous transport and deposition. It is, however, very suggestive of the results likely to be produced by marine glacial transport; and the mixture of coarse and fine, angular and waterworn material, much of which has clearly been derived from distant sources, would also favour this supposition. Grooved or ice-scratched pebbles or rock fragments have, however, not yet been observed."

In the table of formations, which we find at the end of the above work, the Bacchus Marsh beds are placed between Permian and Trias. So much appears at least certain, that they are higher than the Avon Sandstones with the *Lepidodendron,* that they contain a peculiar conglomerate and leaves of the genus *Gangamopteris,* M'Coy. Besides the above, Upper Mesozoic beds are also described.

(5.) 1866. Daintree (R.) Report on the Geology of the District of Ballan. *F'cap. Melbourne,* 1866. (*Government Printer.*)

Also in this Report we find similarly, as in the preceding work, the description of a peculiar conglomerate.

(6.) 1874-75. M'Coy (Prof. F.) Prodromus of the Palæontology of Victoria. *Decades I and II. R. 8vo. Melbourne,* 1874-1875. (*Government Printer*).

Prof. M'Coy described and illustrated in these two volumes the following fossil plants, from—

(*a*) Palæozoic rocks, below the Carbonaceous (apparently Lower Carboniferous) :—

Lepidodendron australe, M'Coy. Avon River, Gippsland.

(*b*) Lower Mesozoic beds :—

Gangamopteris angustifolia, M'Coy,	Bacchus Marsh Sandstone, Bacchus Marsh.
" *spathulata, M'Coy,*	
" *obliqua, M'Coy,*	

(*c*) Upper Mesozoic beds (Carbonaceous) :—

Alethopteris australis, Morr. Bellarine; Barrabool Hills.
Tæniopteris Daintreei, M'Coy. Cape Paterson; Barrabool Hills; Wannon River,
Podozamites (*Zamites*) *Barkleyi*, M'Coy, } Bellarine.
" " *ellipticus*, M'Coy, } Bellarine.
Zamites longifolius, M'Coy, } Bellarine.

(7.) 1874. **Howitt** (A. W.) **Notes on the Geology of part of the Mitchell River Division of the Gippsland Mining District.** *Report of Progress, Geol. Survey Victoria, No. II, pp.* 59, *et seq.*

In this paper are important indications about the Iguana Creek beds and the Avon Sandstone. In the Appendix (p. 72) the Iguana Creek beds are described as "*Base of Carboniferous, or top of Devonian passage beds.*" Also a report of Prof. M'Coy, on a collection of fossils from Iguana Creek, is communicated (p. 72) :—"I have examined the whole of the plants in the rocks from the Iguana Creek, and can recommend that the rocks be coloured as Upper Devonian." Then the fossils are named—*Archæopteris Howitti; Ancimites iguanensis* and *Cordaites australis* (p. 73). He added :—"The collocation of these genera is characteristic of the Upper Devonian, combined with the absence of types, characteristic of the other formations."

Mr. Howitt adds :—"It seems most advisable, in the present state of information, as suggested to me by Prof. M'Coy, that the term Upper Devonian should be restricted to the immediate locality of the plant beds of Iguana Creek, while the remainder of the great group of strata, heretofore known as the Avon Sandstones, should be . . . regarded as Carboniferous."

(8.) 1876. **M'Coy** (Prof. F.) **Prodromus of the Palæontology of Victoria.** *Decade IV. R.* 8*vo, Melbourne*, 1876. (*Government Printer.*)

Contains descriptions and illustrations of fossil plants from the Upper Devonian beds of the Iguana Creek, Mitchell River, Gippsland, mentioned in the previous paper by Mr. Howitt (No. 7).

(9.) 1876. **Smyth** (R. B.) **Report of Progress, Geological Survey of Victoria, 1876.** *No. III. R.* 8*vo, Melbourne*, 1876. (*Government Printer.*)

The contents of this Report are already communicated, under "*New South Wales, No.* 32."

(10.) 1878. **Howitt** (A. W.) **Notes on the Devonian Rocks of North Gippsland.** *Report of Progress, Geol. Survey Victoria*, 1876, *No. V, pp.* 117, *et seq.*

In this paper (p. 128) the Devonian rocks of North Gippsland are divided into three parts, and provisional estimates of each are given. The classification is the following:—

Upper Devonian—
Iguana Creek beds: Sedimentary formations with plant remains ....
Snowy Bluff beds: Contemporaneous felsites and basalts............................ } = 5,750 feet.
Middle Devonian—
Upper Buchan beds: Marine fossiliferous limestones .... = 400 to 500 „
Lower Buchan beds: Calcareous tufas, felsite tufas, breccias, &c................. =750 to 1,000 „
Lower Devonian (?)—
Snowy River porphyries: Felsite ash, agglomerates, massive felsites, &c. ...... = 2,000 „

(11.) 1879. **Howitt (A. W.) Notes on the Physical Geography and Geology of North Gippsland, Victoria.** *Quart. Journ. Geol. Soc., Vol. XXXV, pp.* 1-41.

This contains a detailed description of the district mentioned.

(12.) 1884. **Murray (R. A. F.) Bacchus Marsh District. Geological Surveyor's Report.** *Report of Progress, Geol. Survey, Victoria, No. VII, pp.* 51-56.

The Bacchus Marsh beds are spoken of thus:—"Flanking the extremity of the Silurian ranges of the Lerderderg, and extending from westward of the Werribee gorge to the lower portion of Goodman's Creek, are thick-bedded sandstones, shales, and mudstone conglomerates, classed on the geological maps as Upper Palæozoic, but regarded by Prof. M'Coy, on the evidence of the few fossil plant impressions found in them, as of Triassic or Lower Mesozoic aspect. These fossils consist of several species of *Gangamopteris*, and are of the fern family. They are figured and described in Professor M'Coy's *Prodromus of Victorian Palæontology*, Decade No. II."

(13.) 1884. **Murray (R. A. F.) The Carbonaceous Rocks of Victoria.** *Report of Progress, Geol. Survey Victoria, No. VII, pp.* 78, *et seq.*

The Carbonaceous rocks of Victoria are stated to be unmistakably referable to the Mesozoic Era, and with tolerable certainty to the Oolitic or Jurassic (Middle Mesozoic) Epoch, excepting the Bacchus Marsh Sandstones, whose fossil plant* impressions present a Triassic or Lower Mesozoic aspect.

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* I must state that the fossils alone, being of the genus *Gangamopteris*, would not be able to decide this age. It was only by the similarity of conglomeratic beds, in the Hawkesbury rocks and in the Talchirs in India, that these three were correlated; and as I thought that the Talchir-Karharbari present a Triassic aspect, I assumed it for the Bacchus Marsh beds also.

On page 79 there is given a comparative table of the various strata in Victoria with those of New South Wales with regard to the European standard of stratigraphical sequence.

About the Bacchus Marsh Sandstones we find, p. 79, the following:—"In Mr. R. A. C. Selwyn's work of 1866 the Bacchus Marsh sandstones are classified as Upper Palæozoic, though the opinion is expressed that they may be younger than the Upper Palæozoic rocks at the Avon.* The Bacchus Marsh sandstones, however, contain fossil plant impressions, which Prof. M'Coy regards as of a Triassic or Lower Mesozoic type, and they may therefore be justifiably separated from those of the Avon and Iguana Creek in Gippsland, whose fossil flora is distinctly Palæozoic. At the same time the characteristic fossil plants of the Bacchus Marsh group have not been found in the rocks of the other Victorian Mesozoic areas, nor have the fossils common in all the latter been found in the former, and on this account the Bacchus Marsh sandstones are treated as representing a group distinct from the other Mesozoic rocks of the Colony."

(14.) **1886. Langtree (C. W.) and Murray (R. A. F.)** **Geological Collection—Specimens of Rocks, &c.** *Catalogue of Exhibits in the Victorian Court, Colonial and Indian Exhibition, London,* 1886. *pp.* 151, *et seq.*

(15.) **1879. Feistmantel (Dr. O.)** **The Flora of the Talchir-Karharbári Beds.** *Fossil Flora of the Gondwána System, Vol. III, Part* 1. *Palæontologia Indica, Ser. XII.*

I wrote as follows (p. 31):—"We have now to examine if there is in Australia perhaps another formation which could be better compared with these Talchir-Karharbári beds, or at least as well as the Newcastle beds. In Victoria there is a series of beds, called Bacchus Marsh sandstone, which contains no other fossils but *Gangamopteris;* there are three species described, of which *Gangamopteris obliqua* is the most common, and *Gangamopteris spathulata* rare, while *G. angustifolia* is frequent; all these are represented in the Talchir-Karharbári beds, where *Gangamopteris* also is the characteristic fossil, *i.e., G. obliqua* by *G. cyclopteroides, G. spathulata* by *G. major,* and *G. angustifolia* by the same form."

"It seems, therefore, that the most natural term of comparison for our Talchir-Karharbári beds would be the Bacchus-Marsh sandstones; the age of these strata, however, is not quite clear; but so much appears certain that they are not older than the Newcastle beds (upper coal-measures) of which they may partly be the representatives."

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* If here is meant the work "Notes on the Physical Geography, Geology, &c., by Selwyn and Ulrich," then the above statement is not quite correct. Selwyn, it is true, speaks of the Bacchus Marsh sandstones under the heading of Upper Palæozoic, but distinctly says, on p. 16, that they are probably Triassic or Lower Mesozoic.

Again (p. 32):—" If we assume as an extreme probability that the Bacchus-Marsh sandstones are representatives of the Newcastle beds, and both, therefore, the nearest representatives of the Talchir-Karharbári horizon, it would appear to me that the peculiar plant forms (*Phyllotheca*, *Vertebraria*, and *Glossopteris*) of the Damuda flora . . . . might be considered as a repetition, or reappearance, of these forms of the " Newcastle beds flora."

The above correlation was, as is now firmly established, quite correct, and it was only the subsequent discovery of a peculiar conglomerate in the Hawkesbury beds (see under New South Wales, No. 47) which induced me to correlate the same with the Bacchus Marsh conglomerate and with the group itself, and consequently also with the Talchir-Karharbári beds (compare New South Wales, No. 48). But quite recent discoveries have re-established my former correlations.

(16.) 1886. Oldham (R. D.). Memorandum on the Correlation of the Indian and Australian Coal-bearing Beds. *Records Geol. Survey, India, Vol. XIX, Pt.* 1, *pp.* 39, *&c.*

Mr. Oldham writes (p. 41):—" It is unfortunate for our present purposes that none of the sub-divisions of the Gondwána series in India can be definitely and directly correlated with any of those of the carbonaceous series as exhibited in the Newcastle section, where their relative position is clear and free from doubt. But in Victoria there are some beds containing *Gangamopteris*, known as Bacchus Marsh beds, which seem to be the equivalents of the Talchirs. . . . . But their palæontology is not the only connection between the two, for, like the Talchirs, the Bacchus Marsh beds contain abundant evidence of the action of floating ice."

And further is said:—" It is impossible to account for the formation of such beds as these, except by the agency of floating ice in large masses, and as both the Talchirs and the Bacchus Marsh beds show that when they were deposited the climate was much more severe than that now prevalent, we may take this as indicating that during their deposition there was a widespread glacial epoch corresponding to that which is known to have occurred in post-tertiary times. This consideration, whatever weight might be attached to it, if stood by itself, may certainly be said to corroborate the fossil evidence, and we may consequently take it as certain that the Talchir and Bacchus Marsh beds are the representatives of each other."

On page 46 Mr. Oldham writes:—" Seeing, then, that the palæontology and stratigraphy of the beds so far from contradicting the conclusion derived from the evidence of glacial conditions, are either neutral or support it, we may conclude that the carboniferous marine beds of New South Wales[*] are the most probable equivalents of the Bacchus Marsh beds of Victoria, and hence of the Talchir beds of India."

(17.) **1886. Oldham (R. D.). Homotaxis and Contemporaneity, &c.** *Geological Magazine*, 1886. *Dec. III, Vol. III, p.p.* 293–300.

(18.) **1887. Feistmantel (Dr. O.). Über die pflanzen-und Kohlenführenden Schichten in Indien (beziehungs u. Asien) Afrika und Australien, &c.** *Sitzungsb. Konigl. böhm. Gesellsch. Wissensch.*, 1887, *pp.* 1–102.

The necessary notes referring to Victoria are on pp. 55–59.

In a supplement to the above I have shown how the most recent discoveries establish a correlation of a certain conglomerate bed in the Salt Range in India, which is of Upper Carboniferous age, with the Talchir Conglomerate and, consequently, also with the analogous beds in Victoria and New South Wales.

Besides the above, also, my other various works on the Indian Gondwána flora, and those previously published on the Australian flora, should be referred to here, because they also contain notes on Victoria; they were quoted under the heading "New South Wales," under Nos. 41, 43, 48, 49, 71. Also the various papers of Tenison Woods.

Summary Review of the Plant-bearing Strata in Victoria and their Age.

The various strata containing fossil plants will, from the foregoing literature, show in ascending order the following sequence, when at the same time their fossils will be enumerated, and when also the necessary remarks about their age and correlation will be made. I begin with the Devonian rocks:—

1. Iguana Creek Beds, Gippsland.—From these Prof. M'Coy (Prodr. Pal. Vict., Dec. IV) described the following fossils:—

Archæopteris Howitti, M'Coy,
Sphenopteris iguanensis, M'Coy, } Olive flags of Iguana Creek.
Cordaites australis, M'Coy,

Age—Upper Devonian.

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[*] [There are two marine groups in the Permo-Carboniferous Series of New South Wales. It is presumed that Mr. Oldham here refers to the upper, but this could hardly be gathered from so very vague a statement as the above.—R.E., jnr.]

2. Avon Sandstone, Gippsland.—According to the description these beds are higher than the Iguana Creek beds. From these sandstones Prof. M'Coy (Prodr. Pal. Vict. Dec. I, p. 37–39, Pl. IX) described :—

Lepidodendron australe, M'Coy. Avon River, 5 miles above Bushy Park, Gippsland. *Age*—Lower Carboniferous.

There is no doubt that this group is to be correlated with the Lepidodendron beds at Smith's Creek, near Stroud, in New South Wales, which are also of Lower Carboniferous age, so that the Iguana Creek beds, as of Upper Devonian age, will have to be correlated with the Goonoo Goonoo beds in New South Wales.

3. Conglomerates of the Bacchus Marsh Beds, showing signs of glacial action during their deposition. According to the recent discoveries they are to be correlated with the marine beds below the Newcastle or Upper Coal Measures in New South Wales. (See R. D. Oldham, No. 16.)

Age—Upper Carboniferous.

4. Bacchus Marsh Sandstones.—These beds will naturally represent the beds next above the marine beds in New South Wales, and these are the Newcastle or Upper Coal Measures. This was my original correlation before I had notice of the conglomerate bed in the Hawkesbury rocks. I may in this respect refer to my " Palaeozoische und mesozoische Flora des östlichen Australiens," 1878 (pp. 99–101).

From these beds Prof. M'Coy (Prodr. Pal. Vict., Dec. II) described the following fossils :—

Gangamopteris angustifolia, M'Coy, } Bacchus Marsh Sandstones, Victoria.
" *spathulata*, M'Coy,
" *obliqua*, M'Coy,

Age—Permian.

5. Carbonaceous or Upper Mesozoic Beds.—The chief districts are—Coleraine, on the Wannon River; Cape Otway, with the Barrabool Hills; Western Port; Cape Paterson; Bellarine, near Geelong.

Prof. M'Coy (Prodr. Pal. Vict. Dec. I and II) described the following fossils :—

Alethopteris australis, M'Coy. Bellarine; Barrabool Hills.

Tæniopteris Daintreei, M'Coy. Cape Paterson; Barrabool Hills; Wannon River.

Podozamites (Zamites) Barklyi, M'Coy. Bellarine.
" " *ellipticus,* M'Coy. Bellarine.
" " *longifolius,* M'Coy. Bellarine.

Besides these there is quoted a *Phyllotheca,* as, *P. australis,* M'Coy (Report of Progress, Geol. Survey Victoria, 1874, p. 24; *Ibid* 1876, p. 60), from Cape Paterson..

These beds are to be correlated with the Clarence River beds in New South Wales, and with similar deposits (Carbonaceous-Upper Mesozoic) in Queensland and Tasmania.

Age—Mesozoic-Jurassic.

QUEENSLAND.

The literary sources consist at first of several local Reports, and then of papers of more general contents, wherein the latter were made use of, or where new observations were recorded. I shall quote several of the Reports first.

Literary Review.

(1.) **1868. Aplin (C. D'Oyly H.) Report on the Geological and Mining Features of the Gympie Gold-field.** *F'cap. Brisbane,* 1868. *(Government Printer.)*

(2.) **1870. Aplin ((C. D'Oyly H.) Report on the Geological and Mineralogical Features of a part of the South and North portions of the Burnett District.** *F'cap. Brisbane,* 1870. *(Government Printer.)*

(3.) **1870. Daintree (R.) Progress Report of the Rockhampton Mining District.** *F'cap. Brisbane,* 1870. *(Government Printer.)*

(4.) **1876. Gregory (Hon. A. C.) Report on the Coal Deposits of the West Moreton and Darling Downs Districts.** *F'cap. Brisbane,* 1876. *(Government Printer.)*

(5.) **1879. Jack (R. L.) Report on the Geology and Mineral Resources of the Charters Towers Gold-field.** *F'cap. Brisbane,* 1879. *(Government Printer.)*

(6.) **1879. Nicholson (H. A.) and Etheridge (R., jun.) Description of Fossils from the Burdekin and Fanning River Limestones, &c.** *Annals and Magaz. of Natural History, September and October,* 1879; *and Proceedings of the R. Physical Society of Edinburgh for* 1880.*

(7.) **1879. Jack (R. L.) Report on the Bowen River Coal-field.** *F'cap. Brisbane,* 1879. *(Government Printer.)*

(8.) **1882. Jack (R. L.) Report on the Little River Coal-field, near Cooktown.** *F.'cap. Brisbane,* 1882. *(Government Printer.)*

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* Two papers are here mixed up. The first is, Nicholson (Prof. H. A.) and Etheridge (R., jun.)—Descripion of Palæozoic Corals from Northern Queensland.—*Ann. Mag. Nat. Hist.,* 1879, IV, pp. 216 and 265. The econd is, Etheridge (R., jun.)—On a Collection of Fossils from the Bowen River Coal-field, and the Limestone of he Fanning River, North Queensland.—*Proc. R. Phys. Soc. Edinburgh,* 1880, V, pp. 263-328. (R. E., jun.)

(9.) 1885. **Rands (W. H.)** **Report on the Gold-fields of Raglan, Calliope, Milton, and Cania, in the Port Curtis District, &c.** *F'cap. Brisbane,* 1885. (*Government Printer.*)

(10.) 1872. **Daintree (R.)** **Notes on the Geology of the Colony of Queensland. With an Appendix containing Descriptions of the Fossils, by R. Etheridge, F.R.S., &c., and W. Carruthers, F.R.S., &c.** *Quart. Journ. Geol. Soc., Vol. XXVIII, pp.* 271–356, *Plates IX–XXVII.*

This is a most complete description of the geological features of the province. I shall only refer to those formations which contain plants analogous to those from the previous provinces.

About the Carbonaceous beds we read (p. 283) :—" Up to the present time, within all the area marked on the map as occupied by Carbonaceous Mesozoic strata, only the Maryborough beds have yielded fossil remains other than plants. On tributaries of the Condamine, Brisbane, and Mary Rivers, where numerous coal seams are known to exist, several of which have been and are now being worked, these plant remains are of the same character."

A suite of the Tivoli coal mine fossils were found by Mr. Carruthers, to consist of—

Pecopteris Daintreei.[*]
,, *odontopteroides.*
Cardiocarpum australe.
Cyclopteris cuneata.

Schizopteris elongata.[†]
Tæniopteris Daintreei.
,, *gracilis.*[‡]
,, *australis.*[‡]

The Palæozoic follows next. We find written (p. 285) :—" *Carboniferous.*—Whilst the affinities of the southern coal-field of Queensland are Mesozoic, a northern field, of even larger extent, has a distinct fauna, more resembling the Palæozoic Carboniferous of Europe."

" In the upper portion of the series the organic remains are chiefly confined to plants, the most abundant of which is *Glossopteris,* imbedded with less numerous specimens of *Pecopteris, Sphenopteris,* &c."

" In the lower strata, *Producti, Spiriferæ,* &c., of true Carboniferous age, are found associated with the above flora, though the plants are very sparingly represented and in very imperfect forms."

" The Dawson, Comet, M'Kenzie, Isaacs, and Bowen Rivers drain this Carboniferous area."

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[*] There is nothing mentioned of this plant further on, amongst the described species.

[†] This is further on described as *Sphenopteris.*

[‡] Also these two species are not found again amongst the described ones.

About the marine fossils there is said (p. 286) :—"The whole of these forms agree with those found in the Hunter-river series of New South Wales, which there, as in Queensland, are found at the base of the great Palæozoic coal-group of that Colony." There is also given a section of the lowest observed Coal Measures near Nebo crossing, at the Bowen River, and the following said about it:—"The marine beds are generally argillaceous limestones, often very ferruginous, whilst the upper beds are coarse grits and sandstones, with interstratified shales. In these the impressions of *Glossopteris* are very common, and sometimes beautifully preserved; but I have never been able to find the fauna and flora unmistakably represented in the same bed."

Mr. Daintree continues (p. 288) :—"In fact, throughout Australia, as far as observation has yet extended, *Glossopteris* is confined to the older coal-measures of which the *Producti* and *Spiriferæ*, above described, are the marine representatives. In Tasmania, New South Wales, and Queensland, at least, this holds good; and where *Glossopteris* occurs the associated marine fauna is always of Palæozoic type."

"*In the* Tæniopteris *coal-measures of Victoria, Richmond River, New South Wales, and the Southern coal-field of Queensland no* Glossopteris *has yet been found*, and the *Productus*- and *Spirifera*-beds are also absent. It would seem, therefore, that, apart from the presence of a distinguishing fauna, *Tæniopteris* may be taken as evidence of the Mesozoic, and *Glossopteris* of the Palæozoic coal-formations of Australia."[*]

Devonian.—We find the description of the Devonian as follows (p. 288): —"Lithologically this very extensive development of Palæozoic rocks agrees with the 'Devonian' system of England; and the palæontological evidence is confirmatory of the same idea. In the higher members of this group, which, from their general analogy to the English group of that name, we will term Devonian, specimens of fossil plants are abundantly met with. W. Carruthers, Esq., F.R.S., has described and named those from three widely separated localities—Mount Wyatt,[†] Canoona,[‡] and Broken River,[§]—and refers them all to one form, *Leptophlœum rhombicum*,* previously described by Dawson as occurring in the Upper Devonian series of Canada."

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[*] This may hold good for Australia, although, even from Mr. Daintree's own description (see above), it appears clear that *Glossopteris* prevails in the higher beds of the, what he calls, older coal formation; but in India there occurs *Tæniopteris* and *Macrotæniopteris* in the *Glossopteris* beds (Damuda), while *Glossopteris* reaches up beyond the Rajmahal beds, in which various *Tæniopteridæ* are numerous.

[†] At 147–148° Long. E. and 21° Lat. S.

[‡] At 150–151° Long. E. and 23 Lat. S.

[§] An affluent of the Bowen River, south of Bowen. [The above passage in Mr. Daintree's Memoir throws no light on the exact position of this locality. It may be either the river mentioned by Dr. Feistmantel in this foot-note, or the better known Broken River, a tributary of the Clarke River, itself a branch of the Burdekin River.—R. E., jun.]

"At Mount Wyatt the plant-beds are interstratified with strata containing *Spirifers*, &c."

(11.) 1878-79. Feistmantel (Dr. O.) Palaeozoische und mesozoische Flora des östlichen Australiens. *Palæontographica. Cassel*, 1878-79.

In the second (supplemental) part of the above work I quoted (p. 174), in the comparative tables of the formations in several of the Australian provinces, those from Queensland, according to Mr. Daintree's work.

(12.) 1880. Feistmantel (Dr. O.) Notes on the Fossil Flora of Eastern Australia and Tasmania. *Journ. and Proc. Roy. Soc. N.S.W.*, 1880, *Vol. XIV*, *p.* 103.

The sequence of formations in Queensland is also there quoted according to the mentioned work of Daintree, with descriptions of the plants by Mr. Carruthers.

(13.) 1882-83. Tenison Woods (Rev. J. E.) A Fossil Plant Formation in Central Queensland. *Journ. and Proc. Roy. Soc. N.S.W.*, 1883, *Vol. XVI*, *pp.* 179, *et seq.*, *Pls. XI, XII.*

This paper I consider of great importance, inasmuch as it records the occurrence in Queensland of a fossil flora, entirely representing the flora of the Lepidodendron beds of Smith's Creek near Stroud, and Port Stephens, in New South Wales.

The fossils described and illustrated are:—

Lepidodendron Veltheimianum, Sternberg; also *Knorria* state of the same.

Cyclostigma australe, Feistm.,
Calamites radiatus, Brgt., } Bobuntungen.
Calamites varians, Schloth.,

(14.) 1883. Tenison Woods (Rev. J. E.) On the Fossil Flora of the Coal Deposits of Australia. *Proc. Linn. Soc. N. S. Wales*, 1883, *Vol. VIII*, *Pt.* 1. *pp.* 37-167, *Plates* 1-10 *A.*

(15.) 1886. Clarke (A. W.) Occurrence of Coal in Queensland.† *Catalogue of the Minerals exhibited in the Queensland Court, Colonial and Indian Exhibition of* 1886 (*Cat. Exhibits, Queensland Court*, 1886), *p.* 134.

This contains a brief notice of the various coal deposits, which are described as follows: The Ipswich Basin; Southern Coal-fields; Coal on the Plateau; Northern Coal-fields.

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* Described hereafter as *Lepidodendron nothum*.

† Mr. Clarke remarks that this is a *resumé* of a pamphlet on "The Coal Resources of Queensland," by the Rev. J. E. Tenison Woods, F.G.S., &c., which, I am sorry to say, I could not procure.

(16.) 1886. **Clarke (A. W.)** **Organic Remains of Queensland.** *Loc. cit.* (*Cat. Exhibits, Queensland Court*), 1886, *p.* 152.

Here we find the description of the collection of Queensland fossils, which "has been made by Mr. R. L. Jack, F.G.S., F.R.G.S., Government Geologist, supplemented by contributions from Mr. J. Smith, of Rockhampton, and Mr. W. H. Rands, Assistant Government Geologist," and which was exhibited in the Queensland Court at the Colonial and Indian Exhibition, London, 1886.

Summary Review of the Plant-bearing Strata in Queensland and their Age.

From the foregoing literature and from my own comparisons I think the following sequence of strata will, perhaps, best answer the natural relations:—

1. Mt. Wyatt Beds.—These agree entirely, in petrographical and palæontological respects, with the Goonoo Goonoo beds of New South Wales. They contain:—

Lepidodendron nothum, Ung. Mt. Wyatt; Canoona; Broken River, &c.

Cyclostigma, sp. (near *C. kiltorkense*). Mt. Wyatt.

Prof. M'Coy was of opinion that the *Lepidodendron* of these beds might rather be identical with his *L. australe* from the Lower Carboniferous Avon Sandstones, but since the discovery of the Lower Carboniferous flora in the sandstones of the Drummond Range at Bobuntungen, which is identical with that of the Smith's Creek beds in N. S. Wales, we have, I think, every right to suppose that the Mt. Wyatt beds occupy towards those at Bobuntungen the same position as the Goonoo Goonoo do towards the Smith's Creek beds in New South Wales, or in other words that they are older than Lower Carboniferous.*

Age—Upper Devonian, or eventually transition beds between Devonian and Carboniferous.

2. Drummond Range Sandstones, Bobuntungen Beds.—These were first made known by Mr. Tenison Woods (see No. 13). Their fossil remains are sufficient to show that these beds are to be correlated with those of Smith's Creek, near Stroud, and Port Stephens, in New South Wales. The fossils are:—

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* [So little is at present known of the relations of the *Lepidodendron* beds at Goonoo Goonoo to those in the Stroud district, that the order of succession here suggested must be regarded as very provisional. R.E., jun.]

Lepidodendron Veltheimianum, Stbg.; also,
Knorria state of the same,
Cyclostigma australe, Feistm.,
Calamites radiatus, Brgt.,
,, *varians*, Schloth.,
} Bobuntungen.

It would be interesting if further research would also prove the presence of various species of *Rhacopteris* in these beds in Queensland.

Age—Lower Carboniferous.

3. Coal Measures.—This series is, as mentioned in No. 16, divisible into three groups,* which, as I suppose, represent the Marine beds, together with the Newcastle beds in New South Wales, there being mentioned certain marine beds (Carboniferous) wherein *Glossopteris* is present (Lower Coal Measures), and also an upper or mainly fresh-water series where *Glossopteris* is in abundance (?—Newcastle beds). Of fossil plants there was, however, only mentioned:—

Glossopteris Browniana, Brgt.; Bowen River Coal-field.

Age—Middle and Upper Carboniferous and Permian.

4. Carbonaceous Beds or **Mesozoic Coal Beds.**—These are, as already mentioned (under Nos. 10, 14, and 16) especially developed in the southern coal-fields near Maryborough, Brisbane, Ipswich, and Talgai on the Condamine River. The following plant fossils are known:—

Equisetum rotiferum, T.-W. Walloon Mine, near Ipswich.
Phyllotheca carnosa, T.-W. Walloon Mine, near Ipswich.
Vertebraria equiseti, T.-W. Tivoli Mine, near Ipswich.
,, *towarrensis*, T.-W. Rosewood, 24 miles west of Rockhampton.
Sphenopteris elongata, Carruthers. Tivoli Coal-mine, near Ipswich.
,, *(Hymenophyllites) Baileyana*, T.-W. Rosewood, near Ipswich.

[* This subdivision was first given by Mr. R. L. Jack, in his "Report on the Bowen River Coal-field," p. 36. (F'cap.—Brisbane, 1879.—Government Printer.)—R.E., jun.]

Sphenopteris (Ancimioides) flabellifolia, T.-W. Burnett River.
„ *flabellifolia*, var. *erecta*, T.-W. Burnett River.
Trichomanides laxum, T.-W. Rosewood, near Ipswich.
„ *spinifolium*, T.-W. Rosewood, near Ipswich.
Thinnfeldia odontopteroides, Morr., sp. Tivoli Mine, Ipswich; Bundamba, &c.
Thinnfeldia odontopteroides, var. *falcata*, T.-W. Rosewood, near Ipswich.
Cyclopteris cuneata, Carruthers. Tivoli Mine, near Ipswich.
Alethopteris australis, Morr., sp. Ipswich; Bundamba; New Chum, Clifton Colliery; Darling Downs, near Toowoomba.
Alethopteris concinna, T.-W. (?) Ipswich.
Tæniopteris Daintreei, M'Coy. Talgai Diggings (the true form).
„ *Carruthersi*, T.-W. Tivoli Mine, Ipswich; Rosewood; West Moreton.
Angiopteridium ensis, Oldh., sp. Rosewood, near Ipswich.
Sagenopteris rhoifolia, Presl. Talgai, on the Condamine River, Darling Downs, near Toowoomba.
Gleichenia lineata, T.-W. Rosewood, near Ipswich.
Jeanpaulia bidens, T.-W. Burnett River, west of Maryborough.
Podozamites lanceolatus, Lindl. and Hutt. Ipswich.
Ptilophyllum oligoneurum, T.-W. Rosewood, near Rockhampton.
Otozamites Mandeslohi, Kurr. Talgai Diggings.
Brachyphyllum australe, var. *crassum*, T.-W. Ipswich.
Sequoiites australis, T.-W. Rosewood, near Rockhampton.
Taxites medius, T.-W. Ipswich.
Cunninghamites australis, T.-W. Rosewood, near Ipswich.
Araucarites (?) polycarpa, T.-W. Burnett River.
Cardiocarpum australe, Carruthers. Ipswich.

Age—Lower and Upper Jurassic.

TASMANIA.

The knowledge of the relations of the coal-bearing beds in Tasmania is, in spite of some quite recent works on the subject, rather unsatisfactory, especially with regard to the classification and correlation with the formations of the Australian provinces already described.

(1.) **1845. Strzelecki (Count P. de)** **Physical Description of New South Wales and Van Diemens Land, &c.** 8vo. *London*, 1845.

This work has already been noticed under the heading New South Wales (No. 4), and I shall not repeat again all the remarks here.

The fossil plants collected by Count Strzelecki in the Jerusalem basin were :—

Pecopteris australis, Morr.
,, (now *Thinnfeldia*) *odontopteroides*, Morr.
Zeugophyllites elongatus, Morris.

All these are apparently from the beds above the Marine beds. We shall see further on that there are also Coal Measures within the Marine beds, and that they also have yielded numerous plant remains.

(2.) **1864. Wintle (S. H.)** **Sketch of the Principal Geological Features of Hobart, Tasmania** *Quart. Journ. Geol. Soc.*, 1864, *Vol. XX*, *p.* 465.

(3.) **1875. Crépin (—).** **Notes on Pecopteris odontopteroides.** *Bull. Acad. R. de Belgique*, 1875.

The fossil plants noticed by Crépin are :—

Sphenopteris elongata, Carruthers, } Jerusalem Basin.
Pecopteris odontopteroides, Morr., }

(4.) **1878-79. Feistmantel (Dr. O.)** **Palaeozoische und mesozoische Flora der Östlichen Australiens.** *Palaeontographica, Cassel*, 1878–79.

Amongst the specimens, which were placed by the late Rev. W. B. Clarke at my disposal, and which formed the scientific material for the above work, there were also several specimens from Spring Hill, in the Jerusalem basin. The fossil plants known to me were :—

Sphenopteris elongata, Carr. Jerusalem Basin.
Pecopteris (Thinnfeldia) odontopteroides, Morr.; Spring Hill, Jerusalem Basin.
Alethopteris australis, Morr. Jerusalem Basin.
Sagenopteris tasmanica, Feistm. Spring Hill, Jerusalem Basin.
Zeugophyllites elongatus, Morr. Jerusalem Basin.

These are all from the Mesozoic beds, equivalent of similar beds (Clarence River Series) in New South Wales, and of the Carbonaceous beds in Victoria and Queensland.

(5.) **1880. Feistmantel (Dr. O.)** **Notes on the Fossil Flora of Eastern Australia and Tasmania.** *Journ. and Proc. Roy. Soc., N. S. Wales*, 1880, *Vol. XIV*, *pp.* 103-118.

Also in this paper I had knowledge only of the fossil plants quoted in the preceding work from the Jerusalem Basin.

(6.) **1882-83. Tenison Woods (Rev. J. E.) A Fossil Plant Formation in Central Queensland.** *Journ. and Proc. Roy. Soc. N. S. Wales*, 1883, *Vol. XVI, pp.* 179 *et seq.*

The Tasmanian formations referred to in this paper are;—

1. *Upper Palæozoic*—Don River; Mersey River.
2. *Mesozoic Beds*—Jerusalem Basin.

(7.) **1883. Tenison Woods (Rev. J. E.) On the Fossil Flora of the Coal Deposits of Australia.** *Proc. Linn. Soc. N. S. Wales*, 1883, *Vol. VIII, Pt.* 1, *pp.* 37, *et seq.*

In this work the formations are somewhat differently placed:—

Permian (?)—The Mersey Coal-field, Don River; Spring Bay; Valley of the Derwent.

Jurassic—Jerusalem Basin.

(8.) **1883-84. Stephens (T.). Letters to the Author, by Mr. T. Stephens.**[*]

On the 15th December, 1883, Mr. T. Stephens, Chief Insp. of Schools, Hobart,[†] sent to me some Tasmanian fossils from the Mersey Coal-field and from the Jerusalem Basin. Upon my inquiry about some relations in the mentioned districts, Mr. Stephens wrote to me again on the 6th October, 1884, wherein he made some very important remarks. Thus:—"The coal of the two formations differs materially in character; the Mersey coal always underlies marine beds of unascertained thickness (being generally denuded) containing *Spirifer*, *Productus*, *Fenestella*, *Stenopora*, &c.; and there is also the difference in plant remains. No *Thinnfeldia* or *Pecopteris* has ever been met with in the Mersey beds." Again:—"In reply to your inquiry as to the relative position of the beds in the Mersey Coal Measures, I may say that the marine beds overlie the coal quite conformably, and uniformally disappear in a shaft or bore about 45 feet above the seam which is worked. The band from which the *Glossopteris* came lies between the marine beds and the coal, and about 4 feet above the latter."

(9.) **1884. Stephens (T.) Notes on Boring Operations in search of Coal in Tasmania.** *Papers and Proc. Roy. Soc. Tasmania*, 1884, p. 217.

(10.) **1885. Johnston (R. M.) Geological Table showing the proposed Provisional Classification of Stratified Rocks for Tasmania, 1885.**[‡]

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[*] This refers to the specimens which Mr. Stephens kindly had sent to me.

[†] [Mr. T. Stephens, M.A., now Inspector of Education, Hobart. R.E., jun.]

[‡] [See Papers and Proc. Roy. Soc. Tasmania for 1885-86. The table forms a part of the following paper, No. 11, p. 343. R.E., jun.]

The classification of the plant and Coal beds in this table is given as follows:—

Mesozoic.		Newer intrusive diabase—Variegated sandstones, shales, and coal seams of the Upper Coal Measures at Longford, Rosevears, Hadspen, Ben Lomond, Fingal, Tower Hill, Mt. Nicholas, Oatlands, Spring Hill, Jerusalem, &c., &c.	Plants — *Phyllotheca*, *Vertebraria*,[*] *Sphenopteris*, *Pachypteris*, *Thinnfeldia*, *Cyclopteris*, *Pecopteris*, *Alethopteris*, *Tæniopteris*, *Sagenopteris*, *&c.*
Carboniferous.	Upper.	Upper Marine Beds—Mersey River, Porter's Hill. Tasmanite Beds—Mersey River. Lower Coal Measures—Mersey River.	Marine animals—and plants as *Glossopteris*, *Gangamopteris*, *Nöggerathiopsis*, *Schizoneura*,[†] *&c.*
	Lower.	Lower Marine Beds — Mudstones, Limestones, Conglomerates, &c.	

(11.) **1885. Johnston (R. M.) General Observations regarding the Classification of the Upper Palæozoic and Mesozoic Rocks of Tasmania, together with a full Description of all the known Tasmanian Coal-plants, including a considerable number of New Species.** *Proc. Roy. Soc. Tasmania*, 1885, pp. 343–387.

This is the most elaborate paper on Tasmanian fossils I at present know of. Mr. Johnston speaks at first of the stratigraphical relations, as far as these are known, and he distinguishes two divisions.

Carboniferous System (Upper Palæozoic).—Here he says:—"Although in Europe the upper limits of the Carboniferous system can, with some degree of satisfaction, be separated from the lower limits of the succeeding system, known as the Permian or Dyas, which, according to artificial classification, is deemed to close the Palæozoic age, it is not as yet always possible in other countries, especially in Australasia, to find special stratigraphic or organic characters, whereby the divisions between the two periods can even be most distantly approximated. The two systems, for the purposes of this paper, are therefore grouped as one, under the term *Carboniferous system*."

(12.) **8884–1887. Feistmantel (Dr. O.) Fossils from Tasmania.** Sent by Mr. T. Stephens.

As already mentioned (under No. 7), Mr. T. Stephens was so kind as to forward to me a small collection of fossil plants from Tasmania, which reached me early in 1884. As I was too much occupied with other work I had no time until now to go over the collection more carefully. The specimens sent came from the Mersey Coal-field and from the Jerusalem Basin, therefore from two very different horizons.

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[*] In his later work Mr. Johnston does not quote it with certainty from Tasmania.

[†] Also this plant is not mentioned again.

(*a*) From the Mersey beds I recognized the following:—

Phyllotheca australis, Bgt. (This is the true form, as it occurs in the Newcastle beds, New South Wales.)
Glossopteris communis, Feistm.
„ *Browniana*, Brgt.
„ *spathulato-cordata*, Feistm.
„ *reticulum*, Dana.
Gangamopteris cyclopteroides, Feistm.
„ „ var. *subauriculata*, Feistm.
„ „ var. *attenuata*, Feistm.
„ *angustifolia*, M'Coy.
Nöggerathiopsis Hislopi, Feistm.
Squamæ gymnospermarum.
Samaropsis sp. (?) (winged seeds).

(*b*) From the Jerusalem Basin I could determine:—

Thinnfeldia odontopteroides, Morr. sp.
Alethopteris australis, Morr. sp.

Summary Review of the Plant-bearing Strata in Tasmania, and their Age.

From the foregoing literary material I think the following sequence of strata can be drawn up.

1. Marine and Coal-bearing Series.—This consists (see Nos. 8–11) of various strata, by Tasmanian writers distinguished in ascending order, as—

(*a*) Lower Marine Beds.
(*b*) Lower Coal Measures.
(*c*) Tasmanite Beds.
(*d*) Upper Marine Beds.

This division has apparently been made before the fossils at Porter's Hill, near Hobart, were discovered, which, as can be seen from Mr. Johnston's description (No. 11), are identical with those of the Lower Coal Measures on the Mersey, but occupy a position answering to the Upper Marine beds. It would thus appear that the so-called Lower Coal Measures, together with Upper Marine beds, including the strata at Porter's Hill, near Hobart, form one continuous series, the more as *Gangamopteris angustifolia*, M'Coy, is quoted, also from the Mersey Upper Marine beds.

According to the plant fossils, they appear to me to represent the Newcastle Coal Measures of New South Wales; also the beds above the conglomerates of the Bacchus Marsh beds in Victoria; similar relations are also in Queensland. These beds are especially developed in the northern coal-fields on the Don and Mersey Rivers; and then at Porter's Hill, near Hobart.

The fossils hitherto known from these beds are:—

Phyllotheca australis, Bgt. Mersey Coal Measures.
Glossopteris Browniana, Bgt. Mersey Coal Measures.
„ *ampla*, Dana. Porter's Hill, Hobart (abundant); Mersey
„ *communis*, Feistm. Mersey.
„ *spathulato-cordata*, Feistm. Mersey.
„ *reticulum*, Dana. Mersey.
Gangamopteris angustifolia, M'Coy. Mersey.
„ *spathulata*, M'Coy. Mersey.
„ *obliqua*, M'Coy. Mersey; Porter's Hill, Hobart.
„ *cyclopteroides*, Feistm. Mersey.
„ „ var. *subauriculata*, Feistm. Mersey.
„ „ var. *attenuata*, Feistm. Mersey.
Tasmanites punctatus, Newton. Mersey.
Nöggerathiopsis spathulata, Dana, sp. Mersey.
„ *Hislopi*, Bunb, sp. Mersey.
Squamæ gymnospermarum (?) Mersey.
Samaropsis, sp. (?) (winged seed). Mersey.

The so-called Lower Marine beds of Tasmania would then represent the Upper Marine beds of New South Wales.

Age—Palæozoic; Upper Carboniferous and Permian.

2. Upper Plant and Coal-bearing Series.—These are called "Upper Coal Measures" by Tasmanian writers; but this must be understood in a different sense from the "Upper Coal Measures," or Newcastle Beds of New

South Wales, which, as we already know, contain *Phyllotheca*, *Vertebraria*, a great number of species of *Glossopteris*, also *Gangamopteris*, *Nöggerathiopsis*, &c., while these "Upper Coal Measures" in Tasmania are especially characterized by *Thinnfeldia odoptopteroides*, *Alethopteris australis*, and *Zeugophyllites elongatus*, Morr.; in which respect they are to be correlated with similar beds in Victoria (Upper Carbonaceous), New South Wales (Clarence River Series), and Queensland (Upper Carbonaceous). These coal beds are developed in the eastern and south-eastern part of Tasmania, and fossils are named from the following localities—Newtown Coal Basin, Richmond Coal Basin, Jerusalem Coal Basin, Spring Bay Coal beds, Impression Bay, Tasman's Peninsula, Ben Lomond Coal beds, Mount Nicholas Coal beds, Seymor Coal beds, Campania Sandstones and Shales, Gravelly Beach, Constitution Hill beds, Spring Hill beds, York Plains Coal beds, Longford Coal beds.

The fossils described from these beds are:—

Phyllotheca australis, Bgt. Newtown; Richmond; Campania; Constitution Hill; Jerusalem; Spring Bay; York Plains.

Phyllotheca ramosa, M'Coy, and *P. Hookeri*, M'Coy, are also quoted from the same localities, but I do not think these are separate species.

Sphenopteris lobifolia, Morr. Newtown.

„ *alata*, Brongt. Newtown; Impression Bay.

„ *elongata*, Carr. Newtown; Richmond; Spring Bay; York Plains.

Sphenopteris plumosa, M'Coy. Newtown.

Trichomanides Ettingshauseni, Johnst. Spring Hill.

Rhacopteris Feistmanteli, Johnst. Spring Hill.

Thinnfeldia odontopteroides, Morr. Jerusalem Basin; Spring Hill; Longford; Newtown; York Plains.

Thinnfeldia trilobita, Johnston. Spring Bay.

„ *media*, Woods. Spring Hill.

Pecopteris caudata, Johnst. Spring Bay; York Plains; Longford.

Alethopteris australis, Morr. sp. Newtown; Jerusalem; Spring Bay; Impression Bay; York Plains; Ben Lomond; Longford, &c.

Tæniopteris tasmanica, Johnst. Spring Hill.

„ *Morrisiana*, Johnst. Longford.

Glossopteris linearis, M'Coy. Mount Nicholas.

It may, however, be that, if we take, as will be shown hereafter, also the relations in South Africa, in India, and also in Europe, where in England there are certain glacial breccias in the Permian, into consideration, we shall be obliged to adopt an earlier beginning of the glacial phenomena in Australia and India; or else it may be that in Australia the Bacchus Marsh conglomerates and the Upper Marine beds partly fall into the Permian Epoch, while in India the age of the conglomerates depend greatly on the age of the Productus limestone in the Salt Range, as will be explained hereafter.

Whether the supposition of such a far-spread glaciation, or glacial action, is justified or not I am unable to explain or prove; but the said conglomeratic beds of the named countries show such characters, and are deposited in such a manner, that the explanation of their deposition by the action of floating ice is almost a necessity.

(5.) In Queensland there is above the Bobuntungen beds (Smith's Creek or Stroud beds) a series of strata, which cannot so distinctly be subdivided as the beds in New South Wales above the *Lepidodendron* beds, and in which there are also not described any such conglomeratic beds which would correspond with those in the Marine beds of New South Wales and the Bacchus Marsh beds; but still there is a certain order in the sequence of the strata, of which the uppermost most probably represent the Newcastle beds of New South Wales, while the others, below, represent the "Series of Marine Beds."

(6.) Similarly it is in Tasmania, where the entire division of the so-called Lower Coal Measures represents the whole series in New South Wales between the Hawkesbury Rocks and the Lepidodendron beds. This division then represents the Carboniferous and Permian Epoch.

(7.) If we have found that the Newcastle beds of New South Wales and their correlations in the other provinces of Australia and Tasmania fall at the end of the Palæozoic division, at about the Permian Epoch, then naturally what follows above them will be of younger age, and thus these upper beds represent the Mesozoic division, some of them Triassic and Jurassic, others perhaps Jurassic only.

If we examine the above relations somewhat closer we find the following interesting facts.

(*a.*) We see that a flora of, generally speaking, Mesozoic character occurs in Australia already in the Lower Coal Measures, between beds with a marine Carboniferous fauna, and that this flora passes into the higher beds. If we would take only this flora into consideration, a Mesozoic Epoch would appear to last from Carboniferous beds up to Jurassic.

(*b.*) On the other hand, there are in Mesozoic beds, viz., in the Hawkesbury-Wianamatta Series, heterocercal fishes, which by themselves would be considered as Palæozoic, so that, with regard to the animals only, a Palæozoic Epoch would be found lasting up into Mesozoic strata; while if we consider the stratigraphical and palæontological relations together, the Lower Coal Measures and Newcastle beds, in spite of the so-called Mesozoic flora, are Palæozoic, and the Hawkesbury-Wianamatta beds, in spite of *Palæoniscus*, *Myriolepis*, and *Cleithrolepis*, are Mesozoic.

I might represent these relations in the following manner:—

	Palæozoic.			Mesozoic.	
	Upper Devonian.	Lower Carboniferous.	Permo-Carboniferous.	Wianamatta and Hawkesbury.	Upper Coal Beds, Carbonaceous.
From Geological and Palæontological relations.	Goonoo Goonoo, &c. (N.S. Wales). Queensland. Victoria. *Lepidodendron, &c.*	Smith's Creek. Port Stephens. Bobuntungen (Queensland). Gippsland (Victoria). *Rhacopteris.* *Cyclostigma.* *Lepidodendron.*	Lower Coal Measures. Upper Marine Beds. Newcastle Beds. Bacchus Marsh Beds. Mersey Beds (Tasmania). *Glossopteris.* *Gangamopteris.* *Nöggerathiopsis, &c.*	Heterocercal fish. Labyrinthodonts. Plants. N.S. Wales.	Queensland. N.S. Wales. Victoria. Tasmania (Jerusalem).
Flora only:	Palæozoic.		Mesozoic.		
Fauna only:	Palæozoic.				Mesozoic.

PART II.—PALÆONTOLOGICAL RELATIONS OF THE COAL- AND PLANT-BEARING BEDS.

In the preceding pages the Stratigraphical Relations of the Coal- and Plant-bearing Beds were described according to the works of various authors and observers. Now the fossils occurring in these beds will be described in systematic order.

At first a general tabular view is given, to illustrate in a concise manner the systematic arrangement of the fossils, their stratigraphical distribution, and their occurrence in the various Provinces, according to the geological horizons.

The first great column is for Mesozoic; here are, under sub-column New South Wales, included the Clarence River beds and Wianamatta-Hawkesbury Series. In order, however, to distinguish in which of these the occurrence of the respective fossil is to be indicated, there are to the sign + added *Cl.*, for Clarence River beds; *W.*, Wianamatta Shales; *H.*, Hawkesbury rocks.

The second great column is entitled Permo-Carboniferous. This includes all the beds which fall, with regard to the sequence in New South Wales, between the Lower Carboniferous (Smith's Creek, Stroud; or Bobuntungen, &c.) and the Hawkesbury rocks, in which case the Newcastle beds and their equivalents represent the Permian, and the lower ones Upper and Middle Carboniferous. In order, however, to distinguish whether the respective fossils come from the Newcastle beds (or their equivalents), or from the lower beds, I have added to the sign + a *P.* in the former, and a *C.* in the latter case.

The third great column represents the Lower Carboniferous of Victoria, New South Wales, and Queensland. The fourth or last comprises the Devonian of the three named provinces. The three last columns are comprised under the general heading Palæozoic, and the first is simply designated Mesozoic, without any further subdivision.

TABLE showing the Stratigraphical and Geographical distribution of the Species of Plants, &c., hereinafter described.

Names of Fossils.	Mesozoic.				Palæozoic.											
					Permo-Carboniferous.				Lower Carboniferous.				Devonian.			
	Tasmania.	Victoria.	N. S. Wales.	Queensland.	Tasmania.	Victoria.	N. S. Wales.	Queensland.	Tasmania.	Victoria.	N. S. Wales.	Queensland.	Tasmania.	Victoria.	N. S. Wales.	Queensland.
I.—ANIMALIA.																
1.—Pisces.																
Palæoniscus antipodeus, *Egert.*	...	...	+ *W. H.*	...	...	...	...	...	...	...	...	...	...	...	...	...
Cleithrolepis granulatus, *Egert.*	...	...	+ *W. H.*	...	...	...	...	...	...	...	...	...	...	...	...	...
Myriolepis Clarkei, *Egert.*	...	...	+ *H.*	...	...	...	...	...	...	...	...	...	...	...	...	...
Urosthenes australis, *Dana*	...	...	......	...	...	...	*P* +	...	...	...	...	...	...	...	...	...
2.—Amphibia.																
Labyrinthodont fossil (? Mastodonsaurus)	...	...	+ *H.*	...	...	...	...	...	...	...	...	...	...	...	...	...
Platyceps Wilkinsoni, *Steph.*	...	...	+ *H.*	...	...	...	...	...	...	...	...	...	...	...	...	...
Labyrinthodont (?) remains, *Steph.*	...	...	*W.* +	...	...	...	...	...	...	...	...	...	...	...	...	...
II.—PLANTÆ.																
1.—Equisetaceæ.																
Phyllotheca australis, *M'Coy*	+	+?	......	...	+	...	*P.* +	...	...	...	...	...	...	...	...	...
„ Hookeri, *M'Coy*	...	...	*W.* +	...	...	...	...	...	...	...	...	...	...	...	...	...
„ concinna, *T. W.*	...	...	+ *H.*	...	...	...	...	...	...	...	...	...	...	...	...	...
„ carnosa, *T.-W.*	...	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
Vertebraria australis, *M'Coy*	...	...	......	...	...	...	*P.* +	...	...	...	...	...	...	...	...	...
„ equiseti, *T.-W.*	...	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
„ towarrensis, *T.-W.*	...	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
Equisetum rotiferum, *T.-W.*	...	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
Calamites radiatus, *Bgt.*	...	...	......	...	...	...	...	...	...	...	+	+	...	...	...	...
„ varians, *Bgt.*	...	...	......	...	...	...	...	...	...	...	+	+	...	...	...	...
Annularia australis, *Feistm.*	...	...	......	...	...	...	+ *C.*	...	...	...	...	...	...	...	...	...
Sphenophyllum, sp.	...	...	......	...	...	...	...	...	...	...	+	...	...	...	...	...
2.—Filices.																
Sphenopteris alata, *Bgt.*	+	...	......	...	...	...	*P.* +	...	...	...	...	...	...	...	...	...
„ „ var. exilis	...	...	......	...	...	...	*P.* +	...	...	...	...	...	...	...	...	...
„ Baileyana, *T.-W.*	...	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
„ crebra, *T.-W.*	...	...	+ *H.*	...	...	...	...	...	...	...	...	...	...	...	...	...
„ elongata, *Carr.*	+	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
„ flabellifolia, *T.-W.*	...	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
„ „ var. erecta, *T.-W.*	...	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
„ flexuosa, *M'Coy*	...	...	......	...	...	...	*P.* +	...	...	...	...	...	...	...	...	...
„ germana, *M'Coy*	...	...	......	...	...	...	*P.* +	...	...	...	...	...	...	...	...	...
„ glossophylla, *T.-W.*	...	...	+ *H.*	...	...	...	...	...	...	...	...	...	...	...	...	...
„ hastata, *M'Coy*	...	...	......	...	...	...	*P.* +	...	...	...	...	...	...	...	...	...
„ iguanensis, *M'Coy*	...	...	......	...	...	...	...	...	...	...	...	...	...	+	...	...
„ lobifolia, *Morr.*	+	...	......	...	...	...	*P.* +	+	...	...	...	...	...	...	...	...
„ plumosa, *M'Coy*	+	...	......	...	...	...	*P.* +	...	...	...	...	...	...	...	...	...
Trichomanides laxum, *T.-W.*	...	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
„ Ettingshauseni, *Johnst.*	+	...	......	...	...	...	...	...	...	...	...	...	...	...	...	...
„ spinifolium, *T.-W.*	...	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
Archæopteris Howitti, *M'Coy*	...	...	......	...	...	...	...	...	...	...	...	...	...	+	...	...
„ Wilkinsoni, *Feistm.*	...	...	......	...	...	...	...	...	...	...	+	...	...	...	...	...
Hymenophyllites dubius, *T.-W.*	...	...	+ *H.*	...	...	...	...	...	...	...	...	...	...	...	...	...
Rhacopteris Feistmanteli, *Johnst.*	+	...	......	...	...	...	...	...	...	...	+	...	...	...	...	...
„ inæquilatera, *Gopp.*	...	...	......	...	...	...	...	...	...	...	+	...	...	...	...	...

TABLE showing the Stratigraphical and Geographical distribution of the Species of Plants, &c., hereinafter described—*continued.*

Names of Fossils.	Mesozoic.				Palæozoic.											
					Permo-Carboniferous.				Lower Carboniferous.				Devonian.			
	Tasmania.	Victoria.	N. S. Wales.	Queensland.	Tasmania.	Victoria.	N. S. Wales.	Queensland.	Tasmania.	Victoria.	N. S. Wales.	Queensland.	Tasmania.	Victoria.	N. S. Wales.	Queensland.
Filices—*continued.*																
Rhacopteris intermedia, *Feistm.*	...	...	......	...	...	...	...	...	...	...	+	...	...	...	...	...
„ comp. Römeri, *Feistm.*	...	...	......	...	...	...	...	...	...	...	+	...	...	...	...	...
„ septentrionalis, *Feistm.*	...	...	......	...	...	...	...	...	...	...	+	...	...	...	...	...
Neuropteris australis, *T.-W.*	...	...	+ *H.*	...	...	...	...	...	...	...	...	...	...	...	...	...
Thinnfeldia odontopteroides, *Morr.*, sp.	+	...	*W.H.* +	+	...	...	...	...	...	...	...	...	...	...	...	...
„ „ var. falcata, *T.-W.*	...	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
„ media, *T.-W.*	+	...	+ *H.*	...	...	...	...	...	...	...	...	...	...	...	...	...
„ trilobita, *Johnst.*	+	...	......	...	...	...	...	...	...	...	...	...	...	...	...	...
Odontopteris macrophylla, *T.-W.*	...	...	+ *H.*	...	...	...	...	...	...	...	...	...	...	...	...	...
„ microphylla, *M'Coy*	...	...	*W.* +	...	...	...	...	...	...	...	...	...	...	...	...	...
Cyclopteris cuneata, *Carr.*	+ ?	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
Alethopteris australis, *Morr.*, sp.	+	+	*Cl. W.* + *H.*	+	...	...	...	...	...	...	...	...	...	...	...	...
„ Currani, *T.-W.*	...	...	+ *H.*	...	...	...	...	...	...	...	...	...	...	...	...	...
„ concinna, *T.-W.*	...	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
Pecopteris tenuifolia, *M'Coy*	...	...	*W.* +	...	...	...	...	...	...	...	...	...	...	...	...	...
„ caudata, *Johnst.*	+	...	......	...	...	...	...	...	...	...	...	...	...	...	...	...
Gleichenia dubia, *Feistm*	...	...	*W.* +	...	...	...	...	...	...	...	...	...	...	...	...	...
„ lineata, *T.-W.*	...	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
Merianopteris major, *Feistm.*	...	...	+ *W.*	...	...	...	...	...	...	...	...	...	...	...	...	...
Tæniopteris Daintreei, *M'Coy*	...	+	*Cl.* +	+	...	...	...	...	...	...	...	...	...	...	...	...
„ Carruthersi, *T.-W.*	...	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
„ tasmanica, *Johnst.*	+	...	......	...	...	...	...	...	...	...	...	...	...	...	...	...
„ Morrisiana, *Johnst.*	+	...	......	...	...	...	...	...	...	...	...	...	...	...	...	...
Angiopteridium ensis, *Oldh. (Feistm.)*	...	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
Macrotæniopteris wianamattæ, *Feistm.*	...	...	*W.H.* +	...	...	...	...	...	...	...	...	...	...	...	...	...
Cycadopteris scolopendrina, *Ratte*	...	...	*W.* +	...	...	...	...	...	...	...	...	...	...	...	...	...
Glossopteris Browniana, *Bgt.*	...	...	......	...	+	...	*P.C.* +	*P.C.* +	...	...	...	...	...	...	...	...
„ „ var. præcursor, *Feistm.*	...	...	......	...	...	...	+ *C.*	...	...	...	...	...	...	...	...	...
Glossopteris ampla, *Dana*	...	...	......	...	+	...	*P.* +	...	...	...	...	...	...	...	...	...
„ Clarkei, *Feistm.*	...	...	......	...	...	...	+ *C.*	...	...	...	...	...	...	...	...	...
„ communis, *Feistm.*	...	...	......	...	+	...	+ *P.*	...	...	...	...	...	...	...	...	...
„ cordata, *Dana*	...	...	......	...	...	...	*P.* +	...	...	...	...	...	...	...	...	...
„ elegans, *Feistm.*	...	...	......	...	...	...	+ *C.*	...	...	...	...	...	...	...	...	...
„ elongata, *Dana*	...	...	......	...	...	...	*P.* +	...	...	...	...	...	...	...	...	...
„ gangamopteroides, sp. n.	...	...	......	...	...	...	*P.* +	...	...	...	...	...	...	...	...	...
„ linearis, *M'Coy*	+ ?	...	......	...	...	...	*P.* +	...	...	...	+ ?	...	...	...	...	...
„ parallela, *Feistm.*	...	...	......	...	...	...	*P.* +	...	...	...	...	...	...	...	...	...
„ primæva, *Feistm.*	...	...	......	...	...	...	+ *C.*	...	...	...	...	...	...	...	...	...
„ reticulum, *Dana*	...	...	......	...	+	...	*P.* +	...	...	...	...	...	...	...	...	...
„ spathulato-cordata, n. sp.	...	...	......	...	+	...	*P.* +	...	...	...	...	...	...	...	...	...
„ tæniopteroides, *Feistm.*	...	...	......	...	...	...	*P.* +	...	...	...	...	...	...	...	...	...
„ Wilkinsoni, *Feistm.*	...	...	......	...	...	...	*P.* +	...	...	...	...	...	...	...	...	...
Gangamopteris angustifolia, *M'Coy*	...	...	......	...	+	*P.* +	*P.* +	...	...	...	...	...	...	...	...	...
„ Clarkeana, *Feistm.*	...	...	......	...	...	...	*P* +.	...	...	...	...	...	...	...	...	...
„ cyclopteroides, *Feistm.*	...	...	......	...	+	...	...	...	...	...	...	...	...	...	...	...
„ „ var. attenuata	...	...	......	...	+	...	...	...	...	...	...	...	...	...	...	...
„ „ var. subauriculata	...	...	......	...	+	...	...	...	...	...	...	...	...	...	...	...
„ obliqua, *M'Coy*	...	...	......	...	+	*P.* +	...	...	...	...	...	...	...	...	...	...
„ spathulata, *M'Coy*	...	...	......	...	+	*P.* +	...	...	...	...	...	...	...	...	...	...
„ sp.	...	...	......	...	...	...	*P.* +	...	...	...	...	...	...	...	...	...

Table showing the Stratigraphical and Geographical distribution of the Species of Plants, &c., hereinafter described—*continued.*

Names of Fossils.	Mesozoic.				Palæozoic.											
					Permo-Carboniferous.				Lower Carboniferous.				Devonian.			
	Tasmania.	Victoria.	N. S. Wales.	Queensland.	Tasmania.	Victoria.	N. S. Wales.	Queensland.	Tasmania.	Victoria.	N. S. Wales.	Queensland.	Tasmania.	Victoria.	N. S. Wales.	Queensland.
Filices—*continued.*																
Sagenopteris rhoifolia, *Presl.*	...	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
„ tasmanica, *Feistm.*	+	...	......	...	...	...	...	...	...	...	...	...	...	...	...	...
Caulopteris Adamsi, *Feistm.*	...	...	......	..	...	...	*P.*+	...	...	...	...	...	...	...	...	...
3.—Lycopodiaceæ.																
Lepidodendron australe, *M'Coy*	...	...	......	...	...	...	...	...	...	+	...	...	...	...	...	...
„ nothum, *Ung. (Carr.)*	...	...	......	...	...	...	...	...	...	...	...	...	...	...	+	+
„ dichotomum, *Stbg.*	...	...	......	...	...	...	...	...	...	...	+	...	...	...	...	...
„ Veltheimianum, *Stbg.*	...	...	......	...	...	...	...	...	...	...	+	+	...	...	...	...
„ Volkmannianum, *Stbg.*	...	...	......	...	...	...	...	...	...	...	+	...	...	...	...	...
Knorria state of L. Veltheimianum	...	...	......	...	...	...	...	...	...	...	+	+	...	...	...	...
Cyclostigma australe, *Feistm.*	...	...	......	...	...	...	...	...	...	...	+	+	...	...	...	...
„ sp.	...	...	......	...	...	...	...	...	...	...	...	...	...	...	+	+
Tasmanites punctatus, *Newt.*	...	...	......	...	+	...	...	...	...	...	...	...	...	...	...	...
Lepidostrobus Muelleri, *Johnst.*	+	...	......	...	...	...	...	...	...	...	...	...	...	...	...	...
4.—Cycadeaceæ.																
Podozamites distans, *Presl*	...	...	*W.H.*+	...	...	...	...	...	...	...	...	...	...	...	...	...
„ Barkleyi, *M'Coy*	...	+	......	...	...	...	...	...	...	...	...	...	...	...	...	...
„ ellipticus, *M'Coy*	...	+	......	...	...	...	...	...	...	...	...	...	...	...	...	...
„ longifolius, *M'Coy*	...	+	......	...	...	...	...	...	...	...	...	...	...	...	...	...
„ lanceolatus, *L. & H.*	...	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
Otozamites Mandeslohi, *Kurr*	...	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
Ptilophyllum oligoneurum, *T.-W.*	...	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
Zeugophyllites elongatus, *Morr.*	+	...	......	...	...	...	...	...	...	...	...	...	...	...	...	...
5.—Affinities Uncertain.																
Cordaites australis, *M'Coy*	...	...	......	...	...	...	...	...	...	...	...	...	...	+	...	...
Nöggerathiopsis Hislopi, *Feistm.*	...	...	......	...	+	...	...	...	...	...	...	...	...	...	...	...
„ media, *Dana*, sp.	...	...	......	...	...	...	*P.*+	...	...	...	...	...	...	...	...	...
„ prisca, *Feistm.*	...	...	......	...	...	...	+*C.*	...	...	...	...	...	...	...	...	...
„ spathulata, *Dana*, sp.	...	...	......	...	+	...	*P.*+	...	...	...	...	...	...	...	...	...
6.—Coniferæ.																
Jeanpaulia bidens, *T.-W.*	...	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
„ palmata, *Ratte*	...	...	*W.*+	...	...	...	...	...	...	...	...	...	...	...	...	...
Baiera tenuifolia, *Johnst.* (=Trichopitys)	+	...	......	...	...	...	...	...	...	...	...	...	...	...	...	...
Brachyphyllum australe, *Feistm.*	...	...	......	...	...	...	*P.*+	...	...	...	...	...	...	...	...	...
„ „ var. crassum, *T.-W.*	...	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
Sequoiites australis, *T.-W.*	...	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
Taxites medius, *T.-W.*	...	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
Cunninghamites australis, *T.-W.*	...	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
Araucarites polycarpa, *T.-W.*	...	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
Walchia Milneana, *T.-W.*	...	...	+*H.*	...	...	...	...	...	...	...	...	...	...	...	...	...
Cardiocarpum australe, *Carr.*	...	...	......	+	...	...	...	...	...	...	...	...	...	...	...	...
Samaropsis (?) sp.	...	...	......	...	+	...	...	...	...	...	...	...	...	...	...	...
Squamæ (?) gymnospermarum	...	...	......	...	+	...	*P.*+	...	...	...	...	...	...	...	...	...

DESCRIPTION OF THE SPECIES.

I.—ANIMALIA.

1.—Pisces.

Remains of fossil fish are here only of interest, as they occur with the fossil plants in the coal beds. In the lower series there is only one species quoted by Prof. de Koninck, *i.e.*, *Tomodus convexus* Agass. (?), from the Carboniferous Marine Series at Tilleghary, New South Wales.

The fish which concern us here occur in the Newcastle beds (Upper Coal Measures) and in the Hawkesbury-Wianamatta beds. The most interesting point about them is that they are, partly at least, distinctly *heterocercal.* From the Newcastle beds one species is known, and here the occurrence of a heterocercal fish is quite natural, because, as we have seen, these beds most probably represent the Permian Epoch.

From the Hawkesbury-Wianamatta beds three species are known—one at least certainly, the others probably, heterocercal, and these occur in beds, which, from their position, have to be considered as Mesozoic. In the same beds there also occur Labyrinthodont remains of distinctly Mesozoic habit, and we have thus a clear case of heterocercal fishes surviving into Mesozoic (Triassic and Jurassic) strata, although the same fish were formerly quoted as proving the Palæozoic age of the strata (Hawkesbury-Wianamatta beds) in which they occur. We now know that these fish do not decide the age of the strata, but they have to be considered of the age attributed to the beds from their geological position.

The figures of the three species from the Hawkesbury-Wianamatta are copied from photographs which the late Rev. W. B. Clarke had kindly sent me some years ago; and the tail of *Urosthenes* is copied from Dana's work. I shall introduce the fish in the same manner as they were originally described, because it is not easy from photographs to make any further comparisons. The fish to be mentioned here all belong to the class Ganoidei.

Class—**Ganoidei.**

Order—**HETEROCERCI.**

Obs.—In this order *Palæoniscus*, *Myriolepis* and *Urosthenes* are to be placed, while about *Cleithrolepis* there are some doubts whether it is a heterocercal fish at all.

Genus—PALÆONISCUS, *Agassiz.*

Obs.—This genus has been of late years, especially through the works of Dr. R. Traquair, more closely defined, and species of it have been placed with various other genera, so that I am not quite sure whether the Australian species has further to remain with this genus. For the present, however, it does not matter very much whether it really is or is not a *Palæoniscus.* The late Sir P. de M. G. Egerton did describe it as such. So much is certain, that it is a ganoid heterocercal fish, which indeed belongs to the Palæoniscidæ.

PALÆONISCUS ANTIPODEUS, *Egerton.*

Pl. XXX, Fig. 1.

P. antipodeus, Egerton, Quart. Journ. Geol. Soc., 1864, p. 34, Tab. I, f. 4, and woodcut, p. 5 (the tail).

P. antipodeus, Feistmantel, Palaeoz. u. mesoz. Flora östl. Australiens (Palaeontographica, 1878, Suppl. Bd. III, p. 103.)

P. antipodeus, Quenstedt, Petrefaktenkunde, 1885, 3te Auflage, p. 345.

Obs.—I think Sir P. de M. G. Egerton also determined this species from photographs. He could find no difference in this fish from *Palæoniscus.* Egerton's Tab. I, Fig. 4, is only the body, while on p. 5 there is a woodcut of a true heterocercal tail, which is believed to belong to the same fish; so that, supposing this to be true, even then there could be no doubt about the heterocercal nature of the fish. Later on more complete specimens were found, one of which is that now figured. The heterocercal tail is quite distinct and rather powerful, especially with regard to the lower lobe of the fin.

In my original (German) work on the Australian Flora (*loc. cit.*, p. 104), I have given my reasons why the strata, in spite of the occurrence of *Palæoniscus*, can be of Mesozoic age. I quoted the relations of the Hawkesbury-Wianamatta beds, further the circumstance that *Palæoniscus* is there rather rare, that it occurs together with other fishes which are not quite distinctly heterocercal, that *Palæoniscus* also occurs in the Karoo formation of South Africa, and that *Palæoniscus* and other heterocercal species occur in Mesozoic formations elsewhere. I quoted, amongst others, *Palæoniscus* *superstes,* Egert. (Quart. Journ. Geol. Soc. XIV, p. 64, Pl. 1), from the Keuper, in England; I gave a figure of this on Pl. 6, Fig. 6, and it is again copied on Pl. XXIX, Fig. 9. But I find that in Zittel's "Handbuch der Palæontologie" (1887, I Abth. III Bd., 1 Lief., p. 203), this species is placed with *Dictyopyge.* I am not prepared to decide the question, but I can add that, in the last (third) edition of Prof. Quenstedt's "Petrefaktenkunde" (1885, Pl. 25, Fig. 19), there is figured the tail of a fish, quite distinctly heterocercal, which is from the Lettenkohle (Keuper) of Bibersfeld (Germany.) There are besides this the genera—*Gyrolepis,* Ag.; *Urolepis,* Bell; *Oxygnathus,* Egert.; *Cosmolepis,* Ag.; *Thrissonotus,* Ag.; *Centrolepis,* Egert.; *Lissolepis,* Davis; and *Coccolepis,* Ag.—all heterocercal fishes, belonging to the order Palæoniscidæ, and occurring in Mesozoic (Triassic to Upper Jurassic) strata.

Localities and Horizon.—P. antipodeus was found at Parramatta, in the Wianamatta Shales; also at Gosford, Brisbane Water, in the Hawkesbury rocks (Mesozoic), New South Wales.

Genus—MYRIOLEPIS, *Egerton*, 1864.

MYRIOLEPIS CLARKEI, *Egerton.*

Pl. XXX, Fig. 2.

Myriolepis Clarkei, Egerton, *loc. cit.*, pp. 2, 3, Pl. I, f. 1.
" " Feistmantel, 1878, *loc. cit.*, p. 105.

Obs.—Although no tail of this species is known, yet Sir P. de M. G. Egerton thought to be able to compare it with *Acrolepis,* Ag. Zittel (*loc. cit.*, p. 195) quotes it also amongst the Heterocerci, after *Pygopterus,* Ag. Sir P. de M. G. Egerton himself wrote, "All evidence of the form of the tail is deficient."

Locality and Horizon.—In the Hawkesbury beds, Cockatoo Island, Port Jackson (Mesozoic).

Genus—UROSTHENES, *Dana*, 1849.

(Geology, Wilkes' United States Expl. Expedition, p. 681.)

UROSTHENES AUSTRALIS, *Dana.*

Pl. XXIX, Fig. 7.

Urosthenes australis, Dana, 1849, *loc. cit.*, p. 681.
" " Feistmantel, 1878, *loc. cit.*, p. 82.

This is a large and powerful fish, with a distinctly heterocercal tail, which I reproduce from Dana's original figure.

Zittel (*loc. cit.*, 1887, p. 195) quotes it also amongst the Palæoniscidæ.

Locality and Horizon.—In the Newcastle beds (Upper Coal Measures), at Newcastle, New South Wales (Permian ?).

Genus—CLEITHROLEPIS, *Egerton*, 1864.

(Egerton, *loc. cit.*, p. 3.)

Obs.—There is another fish from the Hawkesbury-Wianamatta beds, the systematic place of which is not quite settled. Sir P. Egerton had two specimens at his disposal, one being an original, a fragmentary specimen with head and part of body. From this Sir P. Egerton was inclined to compare the fish with the genus *Platysomus*, Ag. Of the other he had a photograph (see his Tab. I, Fig. 3), and was the same which I also figured (Pl. XXIX, Fig. 8). About this specimen he wrote (*loc. cit.*, p. 3) :—"A photograph, however, of a second specimen, evidently of the same species, and found in the same locality, shows the posterior portion of the Fish . . . . . , and here we find some striking discrepancies from the corresponding parts in the *Platysomi*. In the last-named genus the dorsal fin commences at the culminating point of the dorsal ridge, and extends thence to the upper lobe of the caudal fin, the component rays diminishing very gradually in length from first to last. The anal fin is the exact counterpart of the dorsal fin. In Mr. Clarke's photograph these fins do not occupy half that space, but commence much nearer to the tail, and decrease very rapidly in the length of the rays. In *Platysomus* the dorsal fin contains from 80–100 fin-rays, whereas in the Australian fish it has only 30.* The caudal fin also shows very different characters in the two genera. *Platysomus* has a very well marked heterocercal tail, whereas, as can be perceived in the very faint photographic record of this organ in the Australian specimen, no trace of such structure can be detected."

It is then quite peculiar why, in spite of this negative evidence, Sir P. Egerton (*loc. cit.*, p. 4) quotes it as related to *Platysomus*, and why Mr. Clarke and others also used to adduce it as evidence of the Permian age of the Hawkesbury-Wianamatta beds. Quenstedt, in his "Petrefaktenkunde" (p. 348), places this fish doubtfully with *Platysomus*.

But if we examine the tail as far as it is possible in the drawing, we find that the tail cannot be considered at all as heterocercal, but at the utmost hemi-heterocercal. The dorsal and anal fins show also different characters from those in *Platysomus*, so much so that, in Zittel's "Handbuch der Palæontologie" (1887, p. 245), it is placed, though with a query, with the Pycnodontidæ. This appears indeed to be rather probable.[*]

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* I could count 29.

CLEITHROLEPIS GRANULATUS, *Egerton.*

Pl. XXIX, Fig. 8.

Cleithrolepis granulatus, Egerton, 1864, *loc. cit.*, p. 3, Pl. I, f. 2, 3.
" " Feistmantel, 1878, *loc. cit.*, p. 104.
" " Zittel, 1887, *loc. cit.*, p. 245.

Obs.—The present figure is from a photograph of the same specimen given in the photograph referred to in the above description of Sir P. Egerton.

Locality and Horizon.—In the Hawkesbury beds at Gosford, Brisbane Water, Broken Bay, and Cockatoo Island, Port Jackson; also in the Wianamatta beds, New South Wales (Mesozoic).

2.—Amphibia.

Labyrinthodontia.

LABYRINTHODONT FOSSIL.

Labyrinthodont Amphibian, Wilkinson, Communication about the discovery of a Labyrinthodont Amphibian in the Hawkesbury Rocks, 1886.
Labyrinthian Fossil, Stephens, Note on a Labyrinthodont Fossil from Cockatoo Island, Port Jackson. (Proc. Linn. Soc. N.S. Wales, 2d ser., 1886, Vol I, pt. 3, p. 931.)
Biloela Labyrinthodont, Stephens, On the Biloela Labyrinthodont. (Proc. Linn. Soc. N.S. Wales, 2d ser., 1887, Vol. I, pt. 4, p. 1113, Pl. XIV.)

Obs.—These remains of a Labyrinthodont Amphibian are compared with *Mastodonsaurus* from the Trias., and also described as indicating this age.

Locality and Horizon.—In the Hawkesbury rocks, Cockatoo Island, Port Jackson (Mesozoic).

[* In this criticism Dr. Feistmantel has quite overlooked the opinion of my friend, Dr. Ramsay H. Traquair, who makes the following remarks on *Cleithrolepis*:—"There only remains the very imperfectly known genus *Cleithrolepis*, Egerton, ... and which, to certain points of resemblance to *Platysomus*, adds the peculiarity of having a homocercal tail." (Ann. and Mag. Nat. Hist., 1875, XV, p. 265.—R.E., jun.)]

PLATYCEPS WILKINSONI, *Stephens.*

P. Wilkinsoni. Stephens. On some additional Lybyrinthodont Fossils from the Hawkesbury Sandstones of N.S. Wales. (Proc. Linn. Soc. N.S. Wales, 1887, 2d ser., Vol. I, pt. 4. p. 1175, Pl. XXII.)

Obs.—The affinities of this specimen are also Triassic, although Mr. Stephens could not refer it to any previously described genus.

Locality and Horizon.—In the Hawkesbury rocks, near Gosford, Brisbane Water, Broken Bay.

LABYRINTHODONT (?) REMAINS.

Labyrinthodont Fossils, Stephens. On some additional Labyrinthodont Fossils, &c. (*Loc. cit.,* p. 1190.)

Locality and Horizon.—In the Wianamatta beds at Bowral, New South Wales.

II.—PLANTÆ.

The remains of fossil plants in the various beds in Australia are much more numerous than the animal remains of land and fresh-water habit,[*] while the marine animals in the Carboniferous and Devonian beds, from which fossil plants are also known, are abundant enough. Of the lower classes, Algæ, Musci, &c., nothing is represented amongst the fossils from the above strata. We begin at once with the Equisetaceous plants.

A.—EQUISETACEÆ, or CALAMARIEÆ.

Obs.—According to the classification in Zittel's "Handbuch der Palæontologie" (II Bd., 2 Lief.), we have Calamarieæ, Equiseteæ, Schizoneureæ, Annularieæ, and Calamiteæ; in an Appendix is added the Sphenophylleæ.

1.—*EQUISETEÆ.*

(True horsetails.)

Obs.—I have myself seen or determined no fossil belonging to this order, but there is one fragment of *Equisetum* described by the Rev. J. E. T. Woods.

[* The sentence, "various beds in Australia," is too sweeping a one so far as New South Wales is concerned. In the later Tertiary and Post Tertiary the converse is the case.—R.E., jun.]

Genus—EQUISETUM, *Linnæus.*

Gen. Char.—"Fructu spicæformi, cylindraceo, oblongo, seu ovato sporangiorum receptaculis peltoideis. Foliis in vaginam connatis."

Obs.—There are about twenty-five species amongst the present flora. In geological times they begin undoubtedly in Triassic rocks, and occur again in Jurassic and Cretaceous beds.

EQUISETUM ROTIFERUM, *Ten. Woods.*

E. rotiferum, Tenison Woods. On the Fossil Flora of the Coal Deposits of Australia. (Proc. Linn. Soc. N.S. Wales, 1883, Vol. VIII, pt. 1, p. 66, Pl. VI, f. 5, 6.)

Sp. Char.—"Stem cylindrical, closely and faintly grooved, joints approximate below, distant above. Leaves carinate, connate into a sheath, the teeth of which are short, flat, rounded, of equal width throughout, adpressed to the stem. The diaphragmata of the joints and leaf scars of the branches are very distinct, round, with radiate lacunæ, varying from 18 to 30, and a central orifice. Fructification unknown."—(*Ten. Woods.*)

Locality and Horizon.—In higher Mesozoic beds at the Walloon Mine, near Ipswich, Queensland.

2.—*SCHIZONEUREÆ.*

Obs.—This order includes especially two genera, *Schizoneura* and *Phyllotheca.*

Schizoneura, Schimper, appears to have a more limited geological distribution, being known from Triassic and Liassic strata only, while *Phyllotheca*, Bgt., shows a wider range. In India *Schizoneura* is known from the so-called Damuda and Panchet groups; in Australia it does not occur, but *Phyllotheca* occurs in both.

Genus—PHYLLOTHECA, *Brongniart*, 1828.

Phyllotheca, Brongniart, Prodrome, 1828, pp. 151 and 175.
„ Morris in Strzelecki, 1845, *loc. cit.*, p. 250, et seq.
„ M'Coy, Ann. and Mag., Nat. Hist., 1847, Vol. XX, Ser. I, p. 152.
„ Dana, Geology U. S. Expl. Expedition, 1849, Vol. X, p. 710.
„ Unger, Gen. et Sp. Plant. Foss., 1850, p. 62.
„ Bunbury, Quart. Journ. Geol. Soc., 1863, Vol. XVII, p. 355.

Phyllotheca, Zigno, Flora Format. Oolithicæ, Padova, 1846-56.
„ Heer, Juraflora Ostsibiriens und des Amurlandes, 1876, p. 43.
„ Feistmantel, Raniganj Flora, (Journ. As. Soc. Bengal, 1876, Vol XLV, p. 346).
„ Heer, Nachträge zur Flora von Irkutsk, p. 4 (Flor. Foss. Arctica, 1878, Vol. V).
„ Feistmantel, Palæoz. und mesoz. Flora von Australiens, 1878, p. 83 (figures).
„ Schmalhausen, Beiträge z. Jurafl. Russlands, (Mem. Acad. Imp. Sc. St. Petersbourg, 1879, 7th Ser., Vol. XXVII, No. 4, 1879, pp. 12, 46, 62).
„ Feistmantel, Flora of the Damuda and Panchet Division (Fossil Flora of the Gondwána System, 1880, Vol. III, pt. 2, pp. 65, &c., and figs).
„ Tenison Woods, 1883, *loc. cit.*, p. 69.
„ Zittel, Handbuch d. Pal., 1880, II Bd., 2 Lief., p. 162.

Gen. Char.—Plantis herbaceis; habitu equisetorum. Caule simplici vel ramoso, articulato, sulcato; ramis ipsis articulatis, striatisque. Foliis verticillatis, basi in vaginam connatis, linearibus et lineari lanceolatis, æqualibus, erecte incurvis, costatis.

Obs.—This genus was first described by Brongniart from the Hawkesbury River, New South Wales. Later it was found in Australia more abundantly and at various horizons. It was described from the Lower Oolite of Italy (Zigno), from the coal beds of India (Raniganj-Kámthi Group), from East Siberia (Heer), from the Altai, and North Siberia, &c.

The distribution of the various species of *Phyllotheca*, as far as they are known to me, is the following :—

(*a*) *Australia.*—*Phyllotheca australis*, M'Coy; including, probably, *P. ramosa* and *P. Hookeri*, M'Coy; *Phyllotheca concinna*, T.-W., and *P. carnosa*, T.-W. These will be discussed hereafter.

The range of this genus in Australia is from Permo-Carboniferous to Jurassic.

(*b*) *India.*—From here only two species are known—*Phyllotheca indica*, Bunb., and *Phyllotheca robusta*, Feistm., from the Raniganj-Kámthi horizon of the Damuda Group.

(*c*) *Siberia.*—There the genus is represented by several species; they are :—*Phyllotheca sibirica*, Heer, was described and figured in 1876 and 1878 by Prof. Heer, from Jurassic beds in the Gouvernement Irkutsk (Siberia); *Phyllotheca delinquescens*, Göpp., described and illustrated by Prof. Schmalhausen (*loc. cit.*, 1879), from Jurassic beds of the Kusnezk basin in the Altai (Siberia), and from the same formation on the lower Tunguska River, North

Siberia; *Phyllotheca socolowskii,* Eichw., and *P. stschurowskii,* Schmalh., described by the same author from the Kusnezk basin; *Phyllotheca striata,* Schmalh., described by Prof. Schmalhausen, from the Jurassic beds of the Petschora country; *Phyllotheca paucifolia,* Schmalh., *Phyllotheca stellifera,* Schmalh., and *P. equisetitoides,* Schmalh., described by the same author (*loc. cit.,* 1879) from Jurassic beds on the lower Tunguska River, North Siberia.

(*d*) *Italy.*—From the Jurassic beds in Northern Italy two species of *Phyllotheca* were described by Baron de Zigno—*Phyllotheca Brongniartiana,* Zigno, and *Phyllotheca equisetiformis,* Zigno.

(*e*) *England.*—No true *Phyllotheca* (I mean no leaved specimen) has hitherto been described from England, and mention of this country is only made because the doubtful *Equisetum laterale,* Phill., is now placed with *Phyllotheca* (see Heer, 1876, *loc. cit.,* and Zittel, *loc. cit.,* 1880).

PHYLLOTHECA AUSTRALIS, *Brongniart.*

Pl. XIV, Figs. 2-5, ? Fig. 1.

Phyllotheca australis, Brongniart, Prodrome, 1828, p. 152.
" " Morris in Strzelecki, *loc. cit.,* 1845, p. 250.
" " M'Coy, *loc. cit.,* 1847, p. 156 (figs.).
" " Dana, *loc. cit.,* 1849, p. 170, Pl. 13, f. 6.
" " Feistmantel, *loc. cit.* 1878, pp., 83-84.
" " Tenison Woods, *loc. cit.,* 1883, p. 72.

Sp. Char.—Caule erecto, simplici vel ramoso, articulato, striato, articulationibus differenter distantibus, spathas gerentibus; spathis longitudinaliter sulcatis, foliaceis; spatharum foliolis elongato linearibus, acutis reflexis.

Obs.—This species appears to occur under various forms; I myself figure various specimens. The stem is articulated; in the joints there are sheaths which are striated, and which at the upper margin run out into leaflets; these leaflets are narrowly elongate and generally somewhat reflected. The stem is besides simple or branched; this, I think, may depend on what part of the plant is preserved, at what state of maturity, and so on. Our Pl. XIV, Fig. 4, shows a nice branched specimen from Newcastle, where the sheaths are very well seen, but the leaflets appear to be broken away; but Pl. XIV, Figs. 2, 3, show single sheaths where the leaflets are well seen, especially Fig. 3, which must be of a very powerful specimen, also from Newcastle. Pl. XIV, Fig. 5, is a specimen of a stem occurring together with *Phyllotheca australis,* and I believe it may belong to the same species.

Pl. XIV, Fig. 1, was in my original work also included under *Phyllotheca australis*, Bgt., but it appears to show two kinds of leaflets of the sheath; those on the stem are somewhat broader and recurved to the stem, while on the branch to the left hand there is an indication of leaflets, which would be of the same kind as those in Fig. 4. It may just be that this is the character of the plant. Otherwise it reminds us of some specimens figured by Baron de Zigno in his "Flora Formationis Ooliticæ," especially of *Phyllotheca equisetiformis*, Zigno, and I would almost feel inclined to refer this one specimen from Newcastle to Zigno's above species. With regard to the other specimens, they bear affinities to Prof. Heer's *Phyllotheca sibirica*, or *vice versâ*.

Of the Indian *P. indica*, Bunb., there are known only some leaved branchlets; they are from the Raniganj-Kámthi horizon of the Damuda Group; they also are closely related to the Australian species, but at the same time they show relations to the Jurassic species of Italy and Siberia as well, so that *Phyllotheca* appears to be a wide-spread and widely ranging fossil.

Locality and Horizon.—In the Newcastle beds (Upper Coal Measures) at Newcastle, N. S. Wales; the figured specimens (Permo-Carboniferous). In the Mersey Coal beds, Tasmania (Permo-Carboniferous). In the Jerusalem Basin and other localities (see *ante*), Tasmania (Mesozoic). At Cape Paterson, Victoria (quoted Rep. of Progress, see *ante*), (Mesozoic.)

In my original paper I included under the above species two others, described as *P. ramosa*, M'Coy, and *P. Hookeri*, M'Coy, and I am also now of the same opinion. But as the two species, especially *P. Hookeri*, have been several times quoted as such, I shall give here their diagnoses.

PHYLLOTHECA RAMOSA, *M'Coy.*

Phyllotheca ramosa, M'Coy, *loc. cit.*, 1847, XX, p. 156, Tab. XI, figs. 2, 3.
,, ,, Tenison Woods, *loc. cit.*, 1883, p. 73.

Sp. Char.—"Stem branched, smooth or striated; sheath half the length of the internodes; leaves thin, linear flat; twice or three times the length of the sheath, with a very fine indistinct midrib."

Obs.—This diagnoses fits quite well to some specimens of *Phyllotheca australis*, Bgt.

Locality and Horizon.—This species was quoted from the Newcastle beds, at Mulubimba, New South Wales.

PHYLLOTHECA HOOKERI, *M'Coy.*

Phyllotheca Hookeri, M'Coy, *loc. cit.*, 1847, XX, p. 157, Tab. XI, figs. 4-7.
" " Tenison Woods, *loc. cit.*, 1883, p. 73.

Sp. Char.—"Stem, simple, coarsely sulcated and ridged longitudinally; sheaths very large, loose, sub-infundibuliform, each sheath extending from one articulation to the next, so as to conceal the stem; leaves about twice the length of the sheaths, thick, narrow, with a strong, prominent midrib."

Locality and Horizon.—In the Wianamatta beds, at Clarke's Hill, near Cobbitty, New South Wales (Mesozoic).

PHYLLOTHECA CONCINNA, *Ten. Woods.*

Phyllotheca concinna, Tenison Woods, *loc. cit.*, 1883, p. 75, Pl. vi, f. 9.*

Sp. Char.—"Stems neatly striated with 15 to 18 ribs terminating in linear leaves which, though slightly curved, do not spread, but lie almost parallel to the stem." The figure is of a very incomplete specimen, which can also be of a stem only.

Locality and Horizon.—In the shales of the Hawkesbury Sandstone, at Sugarloaf Hill (Mesozoic).

PHYLLOTHECA CARNOSA, *Ten. Woods.*

Phyllotheca carnosa, Tenison Woods, *loc. cit.*, 1883, p. 75, Pl. IX, f. 2.

Obs.—This species is founded on very poor material, only one specimen having been observed by the author. According to his description it is very imperfect, but shows a close succession of verticillate leaves, which radiate very slightly from the stem. They are close, obtuse, about half a millimetre wide and five long. They form five cup-shaped divisions on a stem thirty-five millimetres long and ten wide.

Mr. Tenison Woods compares it in some degree with my *Phyllotheca robusta.* To me the figured specimen would rather appear to be a coniferous plant, perhaps a *Pachyphyllum.*

Locality and Horizon.—In the Mesozoic beds of the Walloon Mine, near Ipswich, Queensland (Mesozoic).

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* [In the late Mr. Woods' text this reference is erroneously given as Pl. IX, Fig. 2.—R. E., jun.]

3.—*ANNULARIEÆ.*

Genus—ANNULARIA, *Brongniart*, 1828.

(Prodrome, p. 155.)

Obs.—This genus contains herbaceous plants, the stems of which are articulate subulate, and divided by solid diaphragms at the joints. Branches pinnate. The leaflets are disposed round the diaphragms in whorls, and as the margin of the diaphragm is thickened it appears in the impression as a horizontal ring, round which the leaflets are arranged. They are of various shapes, lingulately, elongately, or spathulately lanceolate, thickish, generally horizontally spread out round the ring mentioned, with a central nerve.

The genus has its widest distribution in the true Coal Measures of Europe, where also its fructification is known. In Australia the genus is represented, I think, by some leaf-whorls, which occur in coal shale below the Upper Marine beds.

ANNULARIA AUSTRALIS, *Feistmantel.*

Pl. XII, Figs. 1, 2.

A. australis, Feistmantel. Pal. und Mesoz. Flora d. östl. Australiens, 1879, p. 154, Pl. VII, figs. 5, 6, 6*a*.

„ Tenison Woods, *loc. cit.*, 1883, p. 86.

Sp. Char.—Caule tenui articulato; foliis verticillatis; verticillis usque ad decem-phyllis; foliis incurvato expansis, membranaceis, lanceolato spathulatis, ad 18 millim. longis; nervo medio percursis.

Obs.—This is the only hitherto known species of *Annularia* from the Australian Coal beds. It resembles somewhat *Annularia longifolia*, Bgt., but the leaflets are not so long, are thinner in their substance, and the whole plant appears to have been much more tender. In the same way the Australian species is distinct from *A. sphenophylloides*, Zenk., and *Annularia radiata*, Bgt.

There is one circumstance to be mentioned now. In his Jura Flora of the Kusnezk Basin in the Altai Mountains,[*] Prof. Schmalhausen has described a genus of coniferous plants under the name *Cyclopitys*, which has its leaves also arranged in whorls, and which to some extent bears resemblance to *Annularia*. In a subsequent paper of his, Professor Schmalhausen[†] has brought my *Annularia australis* into close relation with his genus *Cyclopitys.* I am, however, not quite certain about this correlation, especially as I cannot remember having observed in the Australian specimens a transverse striation to both sides of the midrib of the leaflets, which Prof. Schmalhausen points out as characteristic of his genus. I had for the original description only two specimens at my disposal (these are figured), and it would thus be of great interest, to pay attention to this species, whether additional specimens, when found, will show this characteristic striation or not. Up to this time I do not feel justified in separating our Australian fossil from the genus *Annularia,* although I shall mention it again amongst the Coniferæ.

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[*] Mém. Acad. Imp. Sc. St Pétersbourg, 1879, VII Ser. Tome XXVII, No. 4.

[†] Pflanzenpaläontologische Beiträge (Bull. Acad. Sc. St. Pétersbourg, 1883, Tome XXVIII, pp. 426–438, 2 plates).

Locality and Horizon.—In the coal shales of the Lower Coal Measures (below Upper Marine beds) at Greta, New South Wales (Carboniferous).

4.—*CALAMITEÆ.*

Genus—CALAMITES, *Suckow,* 1784.

Obs.—*Calamites* comprises certain remains of equisetaceous plants, of which generally the stems are represented, and which occur frequently in Carboniferous rocks, but are also known from other strata. The stems are jointed, with diaphragms in the joints; outside surface smooth or sulcate; inside surface always sulcate; leaflets in whorls, long, linear, free, deciduous. Fructification a cone, with sterile and fertile whorls alternating, which is the chief difference from *Equisetum.* There are certain leaved forms, known as *Asterophyllites,* which by some authors are considered as the leaved branches of *Calamites,* and as such are called *Calamocladus.* From Australia two species of *Calamites* are known, one of which has been originally identified by myself, while the other one was quoted on the authority of the late Prof. De Koninck.

CALAMITES (ARCHÆOCALAMITES) RADIATUS, *Brongniart.*

Pl. III, Figs. 1-3.

Calamites radiatus, Brongniart, Histoire d. Vég. Foss., 1828, I, p. 122., Pl. 26.

Calamites transitionis, Göppert, Flora des Übergangsgebirge (Nova Act. Acad. Leop. Carol., 1852, p. 116, Tab. III, IV).

Bornia radiata, Schimper, Traité Pal. Vég., 1869, p. 335, Pl. XXIV.

Calamites radiatus, Heer, Fossile Flora der Bäreninsel, 1871, p. 32, Tab. I-VI.

Archæocalamites radiatus, Stur, Culm Flora des Mährischschlesischen Dachschiefers, 1875, p. 2, Taf. 1, figs. 3-8; Taf. II-IV, Taf. V, figs. 1, 2.

Bornia radiata, Etheridge, jnr., Catalogue, 1878, p. 29.
Bornia radiata, De Koninck, Foss. Pal. Nouv.-Galles du Sud., 1877, Pt. 3, p. 142, Tab. 7, f. 1.
Calamites radiatus, Feistmantel, Palaeoz. und mesoz. Flora d. östl. Australiens, Nachtrag, 1879, p. 144, Taf. VI, f. 1, Taf. VII, 3, 4.
Calamites (Bornia) radiatus, Tenison Woods *loc., cit.*, 1883, p. 83.

Obs.—This is a species which has the ribs in the joints not alternating, but only interrupted; the leaves long, linear; which on the branches are once or twice forked. It is well known in the Lower Carboniferous beds (Limestone and Culm) of Europe, and in Mr. D. Stur's above work it is very minutely discussed. Mr. Stur made it the type of a new genus, *Archæocalamites*, but I think the name *Calamites* does as well. Mr. Stur has also sufficiently illustrated the leaf organs, and has recognized in a specimen from Rothwaltersdorf, in Silesia, which I described as *Asterophyllites*, the fructification of the above species.

I figure two specimens of stems (Pl. III, Figs. 1, 3). In Fig. 2 of same Plate are, I think, represented the leaves of this species. These are narrow, linear impressions, which in some places are forked; but this forking is not so regular, as was described by Mr. Stur; but still I think the said fossil represents the leaves, and I point in this respect to Prof. Heer's Tab. II, Fig. 6, (*loc. cit.*)

Locality and Horizon.—The specimens figured by me are from the Lower Carboniferous beds at Smith's Creek, near Stroud, New South Wales, and they had the numbers 6 (Figs. 1, 3) and 17 (Fig. 2) attached to them, which refer to the section through the strata at the locality named.

It is also quoted by Mr. Tenison Woods from similar beds at Bobuntungen, in the Drummond Range, Queensland (Lower Carboniferous).

CALAMITES VARIANS, *Germar*.

Calamites varians, De Koninck, *loc. cit.*, 1877, Pt. 3, p. 142.
„ „ Etheridge, jun., *loc. cit.*, 1878, p. 30.
„ „ Feistmantel, *loc. cit.*, 1879, p. 145.
„ „ Tenison Woods, *loc. cit.*, 1883, p. 85.

Obs.—I have not seen any specimens of this plant, but I know it only from quotations by Prof. De Koninck and Mr. Tenison Woods.

Locality and Horizon.—Lower Marine beds and Coal Measures, New South Wales (Prof. De Koninck); Drummond Range, Queensland (Mr. Tenison Woods). (Lower Carboniferous.)

EQUISETACEÆ INCERTÆ SEDIS SYSTEMATICÆ.

Genus—SPHENOPHYLLUM, *Brongniart.*

Pl. II, Fig. 8.

Obs.—There is a fragment amongst the Australian fossils which I have referred to the genus *Sphenophyllum*, although I did not venture to determine it specifically.

This genus is chiefly represented in the true Coal Measures of Europe and America; but there is also a *Sphenophyllum antiquum*, Dawson, from Upper Devonian strata at St. John, North America (placed by Prof. Heer with his Ursa horizon). There is a *Sphenophyllum tenerrimum*, Ettgh., from the Culm; but we know also a *Sphenophyllum* from the Gas Coal, Bohemia, which, if not younger, is certainly uppermost Carboniferous, probably transitional between Carboniferous and Permian. In India there is in the Damuda division of the Gondwána System, a plant, apparently equisetaceous, originally described as *Trizygia speciosa*, Royle, later called by some authors *Sphenophyllum trizygia*, which probably represents the Carboniferous *Sphenophyllum* in the Damuda coal beds in India.

The fragment from Australia shows, as far as I could observe, a portion of the stem with a joint and a leaf-whorl. The leaves are pretty large and distinctly cuneiform.

Locality and Horizon.—From the Lower Carboniferous beds at Port Stephens, New South Wales.

Genus—VERTEBRARIA, *Royle*, 1839.

Vertebraria, Royle, Illustrat. Botany and Nat. Hist. Him. Mts., 1839, p. XXIX*, Pl. II, figs. 1-5.
,, M'Coy, Ann. and Mag. Nat. Hist., 1847, Vol. XX, pp. 145-147, Pl. IX, f. 1.
Clasteria, Dana, Geology U. States Expl. Expd., 1849, Pl. XIV.
Sphenophyllum, Unger, Gen. et Spec. Plant. Foss., 1850, p. 71.
Vertebraria, Bunbury, Quart. Journ. Geol. Soc., 1861, Vol. XVII, p. 338, Pl. XI, f. 3.
,, Feistmantel, Raniganj Fossils (Journ. As. Soc. Bengal, 1876, Vol. XLV, p. 347).
,, Feistmantel, Flora of the Damuda and Panchet Divisions (Gondwána Flora, 1880, Vol. III, Pt. 2, p. 71, &c., figs.)
,, Feistmantel, Palaeontographica, *loc. cit.*, 1878, p. 84, &c., figs.
,, Tenison Woods, *loc. cit.*, 1883, p. 75, *et seq.*

Obs.—This peculiar genus of fossil plants is hitherto known with certainty only from India and Australia, and in the latter country especially from the Newcastle beds; the true nature of it is, however, not yet made out satisfactorily.

The first figure of it was given by Royle (*loc. cit.*), from specimens which came from the Indian coal beds. He named the genus, as well as two species, viz., *Vertebraria indica* and *Vertebraria radiata*, which, however, certainly represent only one plant, the one being a longitudinal, the other a cross section.

From Australia it was first made known by Prof. M'Coy, but from a small specimen, which showed the fossil in cross section. M'Coy called it *Vertebraria australis*, and compared it to a *Sphenophyllum* with closely set leaf-whorls. M'Coy's original figure is reproduced on Pl. XIV, Fig. 6; it clearly shows that it can be no *Sphenophyllum*. To some extent it resembles Royle's figure of *V. radiata*.

In 1850 this species was placed by Prof. Unger in the genus *Sphenophyllum*, with the same specific name, upon the authority of Prof. M'Coy. Shortly before Unger's mentioned work appeared there was described by Prof. Dana (*loc. cit.*) another plant from Australia, under the name of *Clasteria australis*. But from a closer comparison we find that this *Clasteria* of Dana agrees well with Royle's genus *Vertebraria*, that it represents the longitudinal section, while M'Coy's figure has to be considered as a cross section of the same. I have reproduced two of Prof. Dana's figures on Pl. XV, Figs. 2, 3.

We have thus a plant which within four years has been described by three different names—*Vertebraria*, M'Coy (1847); *Clasteria*, Dana (1849); and *Sphenophyllum*, Unger (1850).

The *Vertebraria* in India and Australia appear to be closely related, but this relation has rather a doubtful importance, in so far as we do not know the true nature of the plant; at the same time, it is to be mentioned that in Australia the plant is not so common as in India.

A very thorough description of this plant from India was given by Sir Charles Bunbury (*loc. cit.*, 1861), and I have discussed the same subject at length in my paper on some Raniganj Plants (*loc. cit.*, 1876). There I have, starting from Sir C. Bunbury's observations, tried to show that *Vertebraria* most probably represents the rhizoma and rootlets of certain equisetaceous *australis*, which, as M'Coy thought, resembled a *Sphenophyllum*, with closely set leaf-whorls, but which is apparently a cross section of the stem.

Locality and Horizon.—This species is known in Australia only, from the Newcastle beds (Upper Coal Measures) of New South Wales, at various localities (Permian).

VERTEBRARIA EQUISETI, *Ten. Woods.*

Vertebraria equiseti, Tenison Woods, *loc. cit.*, 1883, p. 80, Pl. I, f. 3.

Locality and Horizon.—In grey clay, below the coal in the Tivoli Mine, Ipswich, Queensland (Mesozoic, ? Jurassic).

VERTEBRARIA TOWARRENSIS, *Ten. Woods.*

Vertebraria towarrensis, Tenison Woods, *loc. cit.*, 1883, p. 81, Pl. I, figs. 1, 2, 4.

Locality and Horizon.—At Rosewood, about twenty-four miles west of Rockhampton, Queensland (Mesozoic, Jurassic ?).

B. FILICES.

Obs.—Remains of ferns are the most numerous amongst the fossil plants of the Coal deposits in Australia; I may only point for instance to the numerous species or varieties of *Glossopteris*, and there are others too.

Genus—SPHENOPTERIS, *Brongniart.*

Obs.—This genus is altogether rich in species, especially in the Palæozoic formations; and also from Australia there are several species described, of which, however, I have seen none, so that I can only refer to the literature.

SPHENOPTERIS ALATA, *Brongniart*, sp.

Pecopteris alata, Brongniart, Hist. Vég. Foss., 1828, p. 361, Tab. 128.
Aspidites alatus, Göppert, Syst. Fil. Foss., 1836, p. 358.
Sphenopteris alata, Sternberg, Vers. d. Fl. d. Vorw., 1838, II, p. 131.
„ „ M'Coy, *loc. cit.*, 1847, p. 149.
„ „ Unger, *loc. cit.*, 1850, p. 124.
„ „ Feistmantel, *loc. cit.*, 1878, p. 87.
„ „ Tenison Woods, *loc. cit.*, 1883, p. 89.

Sp. Char.—Fronde tripinnata; rhachidibus alatis; pinnis pinnatis, summis pinnatifidis, pinnulis sessilibus decurrentibus, inferioribus pinnatifidis laciniis 3–6 jugis grosse dentatis, superioribus inciso-dentatis; nervis secundariis in singulo lobo e nervo medio sub-excurrente sub-angulo acuto eggredientibus simplicibus, dichotomisve.

"Frond tripinnate; rachis winged; pinnæ pinnate, above pinnatifid with decurrent sessile pinnules, lower pinnatifid with three to six bluntly-toothed segments, upper ones inciso-dentate; veins either simple or forked, diverging slightly into each lobe from the costa at an acute angle."

Obs.—This species was several times referred to as a Carboniferous fossil, as it was correlated with the *Sphenopteris alata*, Bgt. (*Hymenophyllites Grandini*, Göpp.); but this is not the case, the matter standing as follows. Brongniart originally described a *Pecopteris alata* from Australia, and a *Sphenopteris alata* from the Carboniferous at Gaislautern, near Saarbrück, in Germany. Later on the *Pecopteris alata* was placed by Sternberg with *Sphenopteris*, and has to be quoted as *Sphenopteris alata*, Stbg., or Bgt., sp.; and it cannot be therefore confounded with Brongniart's original *Sphenopteris alata*, which by Göppert was referred to *Hymenophyllites* as *H. Grandini*, while Schimper quoted it as *Sphenopteris Grandini.* Both Morris and M'Coy quoted it in the sense of Brongniart's *Pecopteris alata*, which therefore, as such, could not be considered as a Carboniferous species.

Locality and Horizon.—Hawkesbury River, New South Wales (Brongniart's quotation, no formation); Mulubimba, New South Wales, Newcastle beds (M'Coy).*

SPHENOPTERIS ALATA, *var.* EXILIS, *Morris.*

Sphenopteris alata, var. *exilis*, Morris, *loc. cit.*, 1845, p. 246, Pl. VII, figs. 4, 4*a*.
„ „ Feistmantel, *loc. cit.*, 1878, p. 88.
„ „ Tenison Woods, *loc. cit.*, 1883, p. 90.

Sp. Char.—Fronde subtriangulari basi tripinnatifida; rhachide alata; pinnulis aut contractis aut confluentibus decurrentibus irregulariter lobatis, lobis integris, aut dentatis; nervis tenerris pinnatis.

"Frond somewhat triangular, with a tripinnatifid base; margin of the rachis alate; pinnules either contracted at the base or confluent, decurrent, irregularly lobed, lobes entire or dentate; veins slender, pinnate."

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* [In all probability from the Hawkesbury Sandstone Series also.—R. E., jun.]

Locality and Horizon.—Associated with the former in a light-coloured shale from the Hawkesbury River, New South Wales (probably Newcastle Beds).*

SPHENOPTERIS BAILEYANA, *Ten. Woods.*

Sphenopteris Baileyana, Tenison Woods, 1883, *loc. cit.*, p. 93, Pl. 4, f. 2.

Sp. Char.—"Frond bipinnatifid, membranaceous, rachis winged; pinnules alternate, almost simple, broad at the base, becoming regularly narrower at each lobe, so as to form an almost conical leaflet, emerging at an open angle and curving upwards, the lower shorter, the upper longer and spreading; lobes linear, narrow, rounded, very slightly segmented, much longer in the upper pinnules, the terminal lobe produced; costa conspicuous, reaching the apex; veins very fine, emerging at an acute angle, bifurcating immediately, sending a venule to the end of each lobe."

Locality and Horizon.—In the Carbonaceous beds at Rosewood, near Ipswich (Mesozoic, Jurassic ?).

SPHENOPTERIS CREBRA, *Ten. Woods.*

Sphenopteris crebra, Tenison Woods, *loc. cit.*, 1883, p. 93, Pl. 3, f. 4.

Sp. Char.—"Frond evidently tender and membranaceous, bipinnate; pinnæ wide, alternate, slightly oblique, oblong, quadrate; pinnules so close together as not to be easily distinguished, faintly pinnatifid; lobes a little more oblique than the pinnæ, oblong ovate, with a slightly undulating margin; costa sending off veins, which fork once, and the venules reaching the margin."

Locality and Horizon.—Ballimore Coal-field, Talbragar River, New South Wales (Hawkesbury beds, ? Trias.)†

SPHENOPTERIS ELONGATA, *Carruthers.*

Sphenopteris elongata, Carruthers, in Daintree, *loc. cit.*, 1872, p. 355, Pl. XXVII, f. 1.
" " Feistmantel, *loc. cit.*, 1878, p. 108.
" " Tenison Woods, *loc. cit.*, 1883, p. 92.

Sp. Char.—Fronde dichotome divisa, divisionibus irregulariter pinnatis; pinnis simplicibus, bifurcatis an irregulariter pinnatis; segmentis

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* [As in the case of the former species, this probably came from the Hawkesbury Series. The Newcastle Coal Measures do not occur on the Hawkesbury River proper.—R. E., jun.]

† [Mr. C. S. Wilkinson states that "In lithological character the Ballimore beds somewhat resemble the Upper Coal Measures of Newcastle, to which they may belong." (Notes on the Geology N. S. Wales, 2nd edit., 1887, p. 72) The Rev. J. Milne Curran regards these beds as older than either the Hawkesbury or Clarence Series.—R. E., jnr.]

angustis linearibus, apicem versus attenuantibus; nervo medio singulo; nervos simplices in medio segmentorum (pinnularum) currentes, emittente.

"Frond dichotomously divided, each division irregularly pinnate; pinnæ simple, bifurcate or irregularly pinnate; segments narrow, linear, slightly tapering upwards to the somewhat blunt apex, the costa sending out simple veins, which run along the middle of each segment."

Obs.—Carruthers says that, besides *Thinnfeldia* (*Pecopteris*) *odontopteroides*, it is the commonest fossil, which, however, Mr. Tenison Woods could not confirm.

Locality and Horizon.—In the Upper Carbonaceous beds at the Tivoli Coal Mines, Ipswich, Queensland; in similar beds in the Jerusalem Basin, Tasmania (*Crépin*). (Mesozoic, Jurassic.)

SPHENOPTERIS FLABELLIFOLIA, *Ten. Woods.*

Sphenopteris (*Aneimioides*) *flabellifolia*, Tenison Woods, *loc. cit.*, 1883, p. 94.

Sp. Char.—"Frond delicate, small, bipinnate; rachis terete, somewhat thick; pinnæ oblong, cuneate, contracted at the base to a delicate petiole, lower edge entire, upper divided into linear cuneate lobes of varying width, the edges straight or rounded, some of the pinnæ much elongated; costa inconspicuous; veins fine, close, numerous, straight, radiating."

Locality and Horizon.—Abundantly found in a blue shale on the Burnett River, Queensland (Mesozoic, ? Jurassic).

SPHENOPTERIS FLABELLIFOLIA, *var.* ERECTA, *Ten. Woods.*

Sphenopteris (*Aneimioides*) *flabellifolia*, *var. erecta*, Tenison Woods, *loc. cit.*, 1883, p. 94.

The distinction of this fossil seems hardly to be justified even as a variety.

Locality and Horizon.—At the same locality as the preceding.

SPHENOPTERIS FLEXUOSA, *M'Coy.*

Sphenopteris flexuosa, M'Coy, *loc. cit.*, 1847, p. 150, Pl. IX, figs. 4, 4*a*.
" " Unger, *loc. cit.*, 1850, p. 127.
" " Feistmantel, *loc. cit.*, 1878, p. 88.
" " Tenison Woods, *loc. cit.*, 1883, p. 91.

Sp. Char.—Frondo bipinnata; pinnis longissimis, rhachide flexuosa; pinnulis magnis, moderatim obliquis, inæqualibus, ovatis, utroque in latere lobis duobus; apice trilobato; nervis crassiusculis, numerose ramificatis, septem ramis marginem loborum adtingentibus; tribus lobos apicales intrantibus.

"Frond bipinnate; pinnæ long with a strong flexuous naked rachis; pinnules large, moderately oblique, unequal, ovate; sides cut into two very large, unequal, rounded lobes on each side; apex tri-lobed; veins strong, much branched, seven branches reaching the margin of each lobe, and three going into each of the three lobes of the apex."

Locality and Horizon.—In a bed of brown clay, at Mulubimba, New South Wales (Newcastle beds, ? Permian).

SPHENOPTERIS GERMANA, *M'Coy.*

Sphenopteris germanus, M'Coy, *loc. cit.*, 1847, p. 150, Pl. X, figs. 2, 2*a*.
" *germana*, Unger, *loc. cit.*, 1850, p. 127.
" " Feistmantel, *loc. cit.*, 1878, p. 88.
" " Tenison Woods, *loc. cit.*, 1883, p. 91.

Sp. Char.—Fronde bipinnata; pinnis obliquis, alternis, elongatis, ovatis, rhachibus pinnarum subalatis; pinnulis ovalibus pinnatifidis; lobis obliquis ellipticis tribus aut quatuor in utroque latere, apice pinnularum trilobato; nervis bipinnatis, tribus ramis lobos intrantibus.

"Frond bipinnate; pinnæ oblique, alternate, elongate, ovate with a narrow membranaceous margin; pinnules oval, deeply pinnatifid; lobes very oblique, elliptical, generally three on each side, and the apex of the pinnules three-lobed; veins bipinnate, three branches reaching the margin of each lobe."

Obs.—Approaches very closely *Sphenopteris (Thyrsopteris) Murrayana*, Bgt., sp.

Locality and Horizon.—In shales at Mulubimba, New South Wales (Newcastle beds, ? Permian).

SPHENOPTERIS HASTATA, *M'Coy.*

Sphenopteris hastata, M'Coy, *loc. cit.*, 1847, p. 149, Pl. X, figs. 1, 1*a*.
" " Unger, *loc. cit.*, 1850, p. 127.
" " Feistmantel, *loc. cit.*, 1878, p. 88.
" " Tenison Woods, *loc. cit.*, 1883, p. 90.

Sp. Char.—Fronde bipinnata; pinnis longis, acute lanceolatis, rhachide alata; pinnulis ellipticis, sensim undulato dentatis, tribus lobis obsoletis utroque in margine; nervis bipinnatis duobus ramis lobos intrantibus.

"Frond bipinnate; pinnæ long, acutely lanceolate, with a broad alate margin; pinnules elliptical, obscurely undulate, dentate, having three obsolete lobes on each side; veins bipinnate, two branches reaching each lobe of the margin."

Locality and Horizon.—Not uncommon in the shale of Mulubimba, New South Wales (Newcastle beds, Permian).

SPHENOPTERIS IGUANENSIS, *M'Coy.*

Sphenopteris iguanensis, M'Coy, Prodr. Pal. Victoria, Dec. IV, 1876, p. 22, Pl. XXXVI, f. 35.
" " Tenison Woods, *loc. cit.*, 1883, p. 92.

"Frond dichotomously bi-pinnatifid; segments of usually 5 to 7 lobes oblique elongate cuneate, confluent at base, the apices crenulato-lobate by small acutely angular indentations; veins slender, numerous, forked, diverging from the base, usually about three to each lobe, a few towards the middle stronger than the rest, but no distinct midrib; rachis rather thick; length of pinnules, 1 to 2 inches; greatest width, usually about 4 lines."

Obs.—Prof. M'Coy places this species in the subdivision *Eremopteris*, Schimper.

Locality and Horizon.—In hard olive flags, Iguana Creek, Victoria (Upper Devonian).

SPHENOPTERIS LOBIFOLIA, *Morris.*

Sphenopteris lobifolia, Morris in Strzelecki, *loc. cit.*, 1845, p. 246, Pl. VII, figs. 3, 3*a*.
" " Dana, *loc. cit.*, 1849, p. 715, Pl. 12, f. 12.
" " Unger, *loc. cit.*, 1850, p. 128.
" " Feistmantel, *loc. cit.*, 1878, p. 87.
" " Tenison Woods, *loc. cit.*, 1883, p. 88.

Sp. Char.—Fronde bipinnata; pinnis sublinearibus, elongatis alternantibus; pinnulis membranaceis, inferiorum pinnarum pinnulis equalibus, ovato-oblongis, ad basim contractis, approximatis, tribus lobis subequalibus utraque in parte uno terminali obtuso; pinnulis apicem versus acute trilobis, ac decurrentibus, nervis in lobis furcatis.

"Frond bipinnate; pinnæ somewhat linear, elongate alternate; pinnules membranaceous, those of the lower pinnæ equal, ovate oblong, contracted at the base, approximate, with three nearly equal rounded lobes on each side, and a terminal obtuse one; veins proceeding into each to be divided near the midrib, upper one furcate; the pinnules towards the apex of the frond are rather sharply three-lobed and decurrent, the veins becoming forked in each lobe."

Locality and Horizon.—In the Upper Coal Measures of Newcastle, and at Mulubimba, New South Wales; also on the Dawson River, Queensland (Permo-Carboniferous). R. M. Johnston quotes it from the Upper Coal Measures (Mesozoic) of the New Town Coal Basin, in Tasmania.

SPHENOPTERIS PLUMOSA, *M'Coy.*

Sphenopteris plumosa, M'Coy, *loc. cit.*, 1847, p. 150, Pl. X, figs. 3, 8*a*.
" " Feistmantel, *loc. cit.*, 1878, p. 88.
" " Tenison Woods, *loc. cit.*, 1883, p. 91.

Sp. Char.—Fronde bipinnata; pinnis curvatis, elongatis, angustis, plumosis; pinnulis confertis obliquis, ovatis acuminatis, profunde incisolobatis, apicali trilobata; nervis crassiusculis, numerose furcatis, ramis septem aut octo lobos intrantibus.

"Frond bipinnate; pinnæ curved, elongate, narrow, plumose, margin slightly alate to the rachis; pinnules close, oblique, ovate pointed, deeply cleft into about four oblique mucronate lobes on each side, exclusive of the largely trilobed apex; veins strong, much branched, so that about six branches reach the margin of each of the lobes of the lower side, and seven to each of those of the upper margin."

Locality and Horizon.—In the shale of Mulubimba, New South Wales (Newcastle beds, ? Permian).

SPHENOPTERIS GLOSSOPHYLLA, *Ten. Woods.*

Sphenopteris glossophylla, Tenison Woods, *loc. cit.*, 1883, p. 94, Pl. 4, f. 4.

"Frond very small, with a somewhat thick rachis, repeatedly forking and bearing small, entire, alternate, ovate leaves on which the venation cannot be seen."

Locality and Horizon.—At Ballimore Hill, Talbragar River Coal-field, near Dubbo, New South Wales (? Hawkesbury rocks, ? Triassic).

Genus—TRICHOMANIDES.

TRICHOMANIDES LAXUM, *Ten. Woods.*

Trichomanides laxum, Tenison Woods, *loc. cit.*, 1883, p. 95, Pl. 10, f. 2.

Sp. Char.—"Rhizome creeping, long, slender, sending up at distinct irregular intervals delicate, membranaceous, pinnate fronds; pinnæ emerging at an acute angle, linear or cuneate, bifurcating with one simple free vein to each lobe."

Locality and Horizon.—At Rosewood Scrub, Ipswich, not common (Carbonaceous beds, Mesozoic, ? Jurassic).

TRICHOMANIDES ETTINGSHAUSENI, *Johnston.*

Trichomanides Ettingshauseni, Johnston, *loc. cit.*, 1885, p. 26.

Sp. Char.—"Frond pinnate (or bipinnate ?); pinnæ delicate, membranous, narrow, with closely adpressed, simple, distant, alternate pinnules, similar in character to winged rachis; pinnules simple, linear, sub-decurrent towards winged base, slightly diverging towards bluntly pointed apices. A simple nerve traverses branches and simple pinnule, as in the existing *Hymenophyllum rarum*, Br. Length of pinna, 3 inches; length of pinnules from junction of median nerve to apex, 15 mm.; breadth of pinnules, 1½ mm."

Locality and Horizon.—In the Spring Hill beds, Tasmania (Upper Mesozoic, Jurassic ?).

TRICHOMANIDES SPINIFOLIUM, *Ten. Woods.*

Trichomanides spinifolium, Tenison Woods, *loc. cit.*, 1883, p. 95, Tab. 3, f. 7.

Sp. Char.—"Frond evidently somewhat stiff, spreading, dichotomously dividing, bipinnate; pinnæ opposite, or nearly so, long, linear, and, together with the rachis, membranaceously winged; pinnules nearly opposite or alternate, very short, and quite acute, the apical one long and linear; veins thick, simple, free."

Locality and Horizon.—At Rosewood, near Ipswich, Queensland (Carbonaceous beds, Mesozoic, ? Jurassic).

Genus—ARCHÆOPTERIS, *Dawson.*

This genus was named by Schimper *Palæopteris*. Dawson erected the above name. D. Stur, in his "Culmflora des Mährisch-Schlesischen Dachschiefers," has added new observations and given a list of the various species of *Archæopteris* known up to that time; amongst them is also an *Archæopteris dissecta*, previously known as *Cyclopteris dissecta*, from various places in the Lower Carboniferous strata of Europe. Amongst the Australian fossils there are also several species which, I think, may be rightly placed with this genus.

ARCHÆOPTERIS HOWITTI, *M'Coy.*

A. Howitti, M'Coy, Prodr. Pal. Victoria, *loc. cit.*, 1876, p. 21, Pl. XXXVI, figs. 1, 2, 2*a*.
„ Tenison Woods, *loc. cit.*, 1883, p. 96.

Sp. Char.—"Pinnæ upwards of 4 inches long and about 1½ inches wide; pinnules sub-opposite, imbricate, obliquely ovato-rhomboidal, narrowed to the base, which articulates to the petiole so as to appear slightly decurrent on one face and obliquely inserted on the other; terminal pinnules nearly the size and shape of the lateral ones, but equilateral; average length of each pinnule, 1 inch 1 line; width, 6 lines; nerves slightly radiating, slender (about 14 inches 3 lines across the middle), with two or three dichotomous branches from base to upper margin; edges only slightly lacerated."

Obs.—Allied to *A. Jacksoni* (Upper Devonian beds of Gaspé) and to the *A. hibernica* (Upper Devonian of Kilkenny and Berwickshire).

Locality and Horizon.—Abundant in the olive flags of Iguana Creek, Victoria (Upper Devonian).

ARCHÆOPTERIS WILKINSONI, *Feistmantel.*

Pl. VI, Fig. 2; Pl. X, Figs. 1, 2.

Archæopteris Wilkinsoni, Feistmantel, *loc. cit.*, 1879, p. 148, Pl. VI, figs. 3, 4; Pl. VII, f. 1.

Sp. Char.—Foliis pinnatis; rhachi stricta, striatula, quondam furcata; segmentis (pinnulis) subalternis, oblonge, ovatis, pinnatifidis; laciniis subalternis, cuneiformibus, basi angusta decurrentibus, incisis; lobis denticulatis, terminalibus bi-trilobatis, inciso-dentatis; nervis crebris, flabellato-dichotomis.

"Frond pinnate; rachis straight, somewhat striate, sometimes forked; segments of the pinnules subalternate, oblong, ovate, pinnatifid; segments or slits subalternate, cuneiform, narrowed at the base, decurrent, incised; lobes denticulate, the terminal ones bi-trilobed with incised dentations; veins very close, flabellately dichotomous."

Obs.—Amongst the known forms of *Archæopteris*, the nearest allies to this Australian species are *A. lyra*, Stur,* and *A. dissecta*, Göpp., sp.; but the pinnules are longer, the lobes are wider apart, longer and more slender, and themselves again incised.

Locality and Horizon.—At Smith's Creek, Stroud (Lower Carboniferous).

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* Culmflora d. Mähr.-Schles. Dachschiefers, Pl. V, f. 8.

Genus—RHACOPTERIS, *Schimper*, 1869.

(Traité Pal. Vég., Vol. I.)

This genus is represented in Australia by several species, which were described by me in 1878 and 1879. They were all from Lower Carboniferous strata; but recently Mr. R. M. Johnston has described a species from the Mesozoic beds in Tasmania.

RHACOPTERIS (?) FEISTMANTELI, *Johnston.*

Rhacopteris Feistmanteli, Johnston, *loc. cit.*, 1885, pp. 26, 27.

Sp. Char.—"Frond coriaceous, imparipinnate, handsome; rachis strong; pinnæ sub-opposite, variable, distant, symmetrical or unsymmetrical, lingulate or obovate lanceolate, curved or spreading, greatly contracted at attachment to rachis; terminal pinnule erect, inequilateral, with a rounded lobe on one side at base, somewhat falciform; apex generally more rounded than the terminations of lateral pinnæ; neuration parallel and crowded at contracted or petiolate attachment, thence gently spreading and forking, the lateral nerves terminating in dentate, or curiously recurved and variable laciniate segments, which are more strikingly developed at the base of lateral pinnæ; the central nerves reach the extreme termination of pinnæ; nerves form a somewhat coarse linear grooving on surface of pinnæ, but do not anastomose."

Obs.—It is greatly to be regretted that Mr. Johnston did not figure the specimen, because it would be rather interesting to ascertain the fact whether it be really a *Rhacopteris*, this genus having hitherto been known from Palæozoic strata only.

Locality and Horizon.—In the shaly beds at Spring Hill, Tasmania (Mesozoic).

RHACOPTERIS INÆQUILATERA, *Göppert*, sp.

Pl. III, Fig. 4; Pl. IV, Figs. 1–6; Pl. V, Figs. 1–3; Pl. VI, Fig. 1; Pl. VII, Figs. 1, 3; Pl. VIII, Figs. 1–2; Pl. IX, Figs. 1, 2.

Cyclopteris inæquilatera, Göppert, Flora Sil. Dev. und Unt. Steinkohlf., 1859, p. 72. Tab. 37, figs. 6, 7, *a* and 6.

Palæopteris inæquilatera, Schimper, Traité Pal. Vég., 1874, Vol. III.

Rhacopteris inæquilatera, Stur, Culmfl. Mähr.-Schl. Dachsch., 1875, pp. 75, 76.

" " Feistmantel, Foss. Flora d. östl. Austr., 1878, p. 74, Tab. I, figs. 3, 3*a*; Tab. III; Tab. IV, figs. 1, 2. Nachtrag, 1879, pp. 145–147, and many figures.

" " Tenison Woods, *loc. cit.*, 1883, p. 98.

Otopteris ovata, M'Coy, Ann. and Mag. Nat. Hist., 1847, Vol. XX, p. 148, Pl. 9, f. 2.

Sp. Char.—"Frond pinnate, pinnæ subimbricate, spreading very much, inequilateral, upper side broadly rounded, truncate at the base at a right angle; petiole short, straight, decurrent; veins united at the base, spreading widely and dichotomously divided."

Obs.—From the specimens at my disposal, and which are represented by the above figures, there appears to be little doubt that they represent the above species from the European (Silesia) Mountain Limestone, as far as the figures in Prof. Göppert's work can be used for final comparison.

The specimens represent the fern in various sizes, and all of them show the single leaf. The rachis varies, but in no case is it very thick, showing generally a longitudinal middle line. To this rachis the leaflets are attached with variously long and thick petioles, in an alternating order. The most distinct petioles are seen in Pl. VII, Fig. 1; Fig. 3 on the same plate resembles mostly Prof. Göppert's original figures of ***Cyclopteris inæquilatera.*** The leaflets show on the outer rounded margin generally a more or less pronounced indentation, but there is a specimen, Pl. IV, Fig. 2, which shows the leaflets somewhat deeper incised, but which I also think belongs to the same species. The venation is, as can be seen in Pl. VII, Figs. 1*a*, 1*b*, 1*c*, repeatedly forked.

The specimens figured on Pl. IV, Fig. 3, and Pl. VI, Fig. 1, are from Arowa, from which locality Prof. M'Coy described his ***Otopteris ovata,*** together with ***Glossopteris linearis,*** on account of which latter species he considered the said locality to belong to the upper horizon of the Coal Measures. The late Rev. W. B. Clarke forwarded to me the said two specimens as representing Prof. M'Coy's ***Otopteris ovata***; but from comparison with the other figures of ***Rhacopteris inæquilatera,*** it will be seen that the former must be joined with the latter. This is in so far of importance as the locality Arowa has, in consequence of this identification, to be placed on the same horizon as Smith's Creek and Port Stephens, from whence ***Rhacopteris inæquilatera*** is known, and which, as shown before, belong to the Lower Carboniferous Series.

But this identification has a further important bearing. If it can be accepted as certain that ***Glossopteris linearis*** occurred together with the said ***Otopteris ovata,*** now to be considered as ***Rhacopteris inæquilatera,*** then it has to be relegated to the same horizon of Lower Carboniferous beds; and this occurrence would thus be the oldest known, because the Lower Coal

Measures—at Greta, Stony Creek, &c., where also *Glossopteris* occurs—are on a higher horizon than the beds of Smith's Creek, near Stroud, and Port Stephens.

Locality and Horizon.—At Smith's Creek, near Stroud—Pl. IV, Fig. 1 (No. 13), Fig. 2 (No. 18), Fig. 4 (No. 10), Fig. 5 (No. 13), Fig. 6 (No. 16); Pl. VII, Fig. 1 (No. 16), Fig. 3 (No. 14); Pl. VIII, Fig. 1 (No. 16), Fig. 2 (No. 16), Fig. 3 (No. 14). At Arowa—Pl. IV, Fig. 3; Pl. VI, Fig. 1. Port Stephens—Pl. V, Figs. 1, 3; Pl. IX, Fig. 1. All in New South Wales (Lower Carboniferous beds).

RHACOPTERIS INTERMEDIA, *Feistmantel.*

Pl. VI, Fig. 3.

Rhacopteris intermedia, Feistmantel, *loc. cit.*, 1878, p. 75, Pl. 2, f. 3.
" " Tenison Woods, *loc. cit.*, 1883, p. 98.

Sp. Char.—Fronde pinnata; rhachi crassa, linea media prominente percursa; pinnulis alternantibus pedunculatis, oblonge rhombeis laciniatis, laciniis cuneatis, mediis longissimis, in pinnulis superioribus rarioribus; marginibus laciniarum denticulatis; nervis pluribus furcantibus, in lacinias radiantibus.

"Rachis thick, with a prominent mesial angle; pinnules alternate pedunculate, oblong rhomboid, incised into cuneate segments, the centre longest, incision scarcely marked above; margins of the segments denticulate; veins numerous, forking, radiating into the segments."

Obs.—This form shows various characters, which place it between *Rhacopteris transitionis*, Stur, and *R. Machanecki*, Stur.

Locality and Horizon.—In Lower Carboniferous beds at Port Stephens, New South Wales.

RHACOPTERIS (?) ROEMERI, *Feistmantel.*

Pl. VII, Figs. 2, 2*a*.

R. Roemeri, Feistmantel, Zeitschr. d. D. Geol. Gesellsch., 1873, XXV, 3, p. 508, Taf. XV, f. 11.
" Feistmantel, Foss. Fl. v. Austr. Nachtr., 1879, p. 147, Pl. II, figs. 2, 2*a*.
" Tenison Woods, *loc. cit.*, 1883, pp. 98, 99.

Obs.—There are only two pinnulæ of one specimen preserved, which, by their general form, and by the mode of incision, resemble very much that species, which I described in 1873 as *Sphenopteris Roemeri*, from Lower

Carboniferous strata in Silesia. Dionys Stur has shown that the above *Sphenopteris* is to be placed with *Rhacopteris*, and to this *Rhacopteris Roemeri* I refer the above figured specimen from Australia. It was sent to me by the late Rev. W. B. Clarke.

Locality and Horizon.—In Lower Carboniferous beds, at Smith's Creek, near Stroud, New South Wales.

RHACOPTERIS SEPTENTRIONALIS, *Feistmantel.*

Pl. III, Fig. 5.

Rhacopteris septentrionalis, Feistmantel, *loc. cit.*, 1879, p. 147, Pl. IV, f. 5.

Sp. Char.—Foliis pinnatis, rhachi linea longitudinali percursa, pinnulis subalternis, breviter petiolatis, suberectis oblongis, rhachim versus profunde bilobatis, dehinc subflabelli formibus; lobis forma subrhombeis, profunde fissis, laciniis apice rotundatis; nervatione indistincta, ut videtur dichotoma, ramis nervorum lacinias intrantibus.

Rachis as in *R. intermedia*; pinnulæ subalternate with short petiols, suberect, oblong, deeply lobed near the rachis, and thence subflabelliform; lobes subrhomboid, deeply incised, segments rounded above; venation indistinct, as it appears dichotomous, branches of veins entering the lobes.

Obs.—Resembles somewhat *Rhacopteris transitionis*, Stur, but is a more slender form altogether.

Locality and Horizon.—In the Lower Carboniferous beds at Smith's Creek, near Stroud, New South Wales.

HYMENOPHYLLITES DUBIA, *Milne-Curran.*

Hymenophyllites dubia, Milne Curran, On some Fossil Plants from Dubbo, New South Wales (Proc. Linn. Soc. N.S.W., 1885, Vol. IX.*)

Locality and Horizon.—In the Hawkesbury Sandstone at Dubbo, New South Wales (Lower Mesozoic).

Genus—NEUROPTREIS, *Brongniart.*

Obs.—This genus belongs to the group of Neuropterideæ, which, according to Schimper,† contains especially species from the Carboniferous rocks, which he unites in the genus *Neuropteris*, Bgt., and some other

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[* Pt. 2, p. 253, t. 9, figs. 1, 2. The locality is West Dubbo.—R.E., jun.]

† Zittel, Handbuch der Palæontologie; Palæophytologie von Prof. Schimper, 1879, pp. 116 *et seq.*

Mesozoic forms, especially Triassic, which he calls *Neuropteridium.* I have myself seen no *Neuropteris* from Australia, but the Rev. Tenison Woods describes one species, which, however, might rather be placed with *Neuropteridium,* as it has a single pinnate frond, and, besides, appears to come from Mesozoic strata.

NEUROPTERIS (? NEUROPTERIDIUM) AUSTRALIS, *Ten. Woods.*

Neuropteris australis, Tenison Woods, *loc. cit.*, 1883, p. 100, Pl. 8, figs. 4, 5.

Sp. Char.—"Frond pinnate, with a thick, broad, conspicuously grooved rachis; pinnæ ovate and lingulate, the lower ones moderately and irregularly lobed and obtuse, unsymmetrical, the upper ones ovate, acuminate with an acute apex, the apical pinnules trifoliate, with lobes broadly rounded, and affixed to the rachis by a somewhat broad petiole; veins rather thick and prominent, radiating from the base, the venules running almost parallel in a curve to the margin; length of lower pinnules 15 to 20 mm., breadth 8 to 10 mm., upper ones gradually diminishing in length and breadth to the summit of the frond."

Obs.—The figured specimen is not very complete, so that it is not easy to compare it with other known forms; but, as already mentioned above, it would really appear to be of the type of *Neuropteridium.*

Locality and Horizon.—Mr. Tenison Woods says that the specimen was found in the gravel of the Bell River, near Wellington, New South Wales, in an ironstone which was evidently derived from some of the limonite nodules such as are obtained from the Hawkesbury beds; the formation is thus not quite certain.

Genus—THINNFELDIA, *Ettingshausen.*

Obs.—In this genus I placed originally a species of fern, which is frequent enough in Australia and Tasmania, and which was variously described as *Pecopteris* or *Odontopteris.* As regards the position of this genus, it is placed by Schimper (Handbuch der Palæontologie, p. 123) in the group of Lomatopteridеæ, together with *Lomatopteris* and *Cycadopteris.*

THINNFELDIA ODONTOPTEROIDES, *Morris,* sp.

Pls. XXIII—XXV, Pl. XXVI, Figs. 1, 2; Pl. XXVIII, Fig. 8; Pl. XXIX, Figs. 1-5.

Pecopteris odontopteroides, Morris in Strzelecki, Phys. Descrip. N.S. Wales, &c., 1845, p. 249, Pl. VI, figs. 2-4.

Gleichenites odontopteroides, M'Coy, Ann. Mag. Nat. Hist., 1847, Vol. XX, p. 147.

" " Unger, Gen. et Sp. Plant. Foss., 1850, p, 208.

Cycadopteris ? odontopteroides, Schimper, Traité Pal. Vég., 1869, p. 488.
Alethopteris ? odontopteroides, Schimper, *Ibid.*, p. 569.
Pecopteris odontopteroides, Carruthers, Quart. Journ. Geol. Soc., 1872, Vol, XXVIII, p. 355, Tab. 27, figs. 2, 3.
Pecopteris odontopteroides, Crépin, Bull. Acad. R. Belgique, 1875, Vol. XXXIX, 2d Ser., pp. 258–263, figs. 1-5.
„ „ Etheridge, Catalogue of Australian Fossils, 1878, p. 98.
Thinnfeldia odontopteroides, Feistmantel, Foss. Flora v. Australiens, *loc. cit.*, 1878–79, pp. 80, 89, 105, 108, Tab. XIII, f. 5; Tab. XIV, f. 5; Tab. XV, f. 3–7; Tab. XVI, f. 1; pp. 165–169, IX–XI.
„ „ Tenison Woods, *loc. cit.*, 1883, pp. 101 *et seq.*

Obs.—This plant was first collected by the Count Strzelecki, at Spring Hill, Jerusalem Basin, and was described in 1845, by Prof. Morris, as *Pecopteris odontopteroides.* Prof. Morris gave the following diagnosis:—"Frond pinnatifidly bipinnate, or flabellate?; pinnæ linear, elongate, acuminate; pinnulæ opposite, approximate, adnate, ovate, obtuse, entire; veins nearly obliterated."

About the systematic position of the fern Prof. Morris was not quite certain; the venation reminded him of an *Odontopteris;* regarding the general form, it resembled somewhat the *Neuropteris conferta;* but still it appeared to him to be more related to *Odontopteris permiensis.*

Prof. M‘Coy thought that the dichotomy of the leaf called to mind the living *Gleichenia*, and he therefore called the fern *Gleichenites;* he, however, gave no figures. Prof. Morris' specimens were not very complete, and the venation was rather indistinctly preserved. Schimper, in his "Traité de Paléontologie Végétale," has quoted the species in the same volume under two different names, viz., as *Cycadopteris ? odontopteroides* (p. 488), and as *Alethopteris? odontopteroides* (p. 569), and, what is rather surprising, with both different names are also given different diagnoses.

Figures of this species were given again in Mr. Carruthers' paper on specimens from Queensland. Both his figures show a dichotomy of the leaf; the leaflets are smaller than in Prof. Morris' specimens, but still Mr. Carruthers thinks both forms are identical. He gave the following diagnosis:—"Frond with a very short and thick stipe, dichotomously divided, the simple portion of the base of the frond, as well as each branch, pinnatifid; the segments more or less opposite, quadrate ovate, with the apex obliquely truncate, connate at the base; one vein passing into the centre of the segment and repeatedly dichotomous, several lateral veins, simple or dichotomous, passing direct from the rachis into the upper and under portions of the segment." Carruthers does not think that this species is a *Gleichenites.*

A further illustration and discussion of this plant is given by Mr. Crépin. He compares his figures with those of Mr. Carruthers and Prof. Morris, and concludes that all represent the same plant; and this the more so as, on the same specimens from Tasmania, there occurred, together with *Pecopteris odontopteroides,* Morr., also another plant, viz., *Sphenopteris elongata,* Carr., in the same manner as Mr. Carruthers has also observed it in specimens from Queensland, which of course shows that both localities belong to the same formation.

Speaking of the systematic position of this species, Mr. Crépin was of opinion that it should be placed in *Odontopteris,* and compares it especially with *Odontopteris alpina,* Gein., apparently because he thought the specimens came from the Coal formation; but this is not the case. I have mentioned before that Mr. Crépin himself noticed the identity of the species upon the specimens from Tasmania and Queensland, from which one can also judge of the identity of formations. Now, as shown before, the strata with *Pecopteris (Thinnfeldia) odontopteroides* in Queensland are of Mesozoic age; so that also the beds in the Jerusalem Basin, from whence Mr. Crépin's specimens have been obtained, have to be considered of the same age, which has, besides, already been shown in the preceding pages.

Cardiocarpon australe, Carr., therefore, cannot even be considered as belonging to the Coal formation (Carboniferous), as Mr. Crépin believes, because it was also at first described from Mesozoic rocks in Queensland.

With regard to *Pecopteris odontopteroides,* Mr. Crépin also mentions the dichotomy of the leaf, but does not consider it in any way as a specific character. Etheridge, in his "Catalogue," quotes this species as *Pecopteris odontopteroides,* but in the section "Mesozoic." In my first paper on Australian plants (1878) I placed it with *Thinnfeldia,* and I do not see any reason now for placing it elsewhere. We have thus a plant before us which, from the venation, belongs to the Odontopterideæ (or Neuropterideæ), but not to the Pecopterideæ. From *Odontopteris* this species differs by its venation, as the greater number of veins originate, as it were, from the base of a chief vein, and by the repeated dichotomy of the same chief vein, which is, however, only short. This mode of venation distinguishes it also from the genus *Ctenopteris.* The form of the leaflets, as well as the venation, distinguish it in a like manner from *Pachypteris,* Bgt., and *Dichopteris,* Zigno, both of which, it appears, are in close relation to each other. There is, therefore, only the genus *Thinnfeldia* into which this Australian plant can be best placed, especially if we compare the figured specimens of Mr. Carruthers (*loc. cit.*, Pl. XXVII, Figs. 2, 3), of Mr. Crépin (*loc. cit.*, Figs. 1–4), and those of myself (*loc. cit.*, 1878, Pl. XV, Figs. 5–7, and Pl. XVI, Fig. 1, or now Pl. XXVI, Figs. 1, 2, and Pl. XXIX, Figs. 1, 5), with the figures of Prof. Geinitz's *Thinnfeldia crassinervis.*[*] This also shows dichotomy of the leaf, similar leaflets, and a similar venation.

I have figured a good number of specimens from various localities; in several cases they differ in the size of the leaf, and also of the leaflets; in some instances also apparently in the venation, but if thoroughly compared it will be found that all the various leaf varieties belong to the same species.

The diagnosis of this species given by me, in 1879, was as follows:—"Fronde magnitudine variante, nunc tenera, mediocri, nunc robusta, valida; simplici an dichotome divisa; frondibus quæ, simplices sunt, pinnato-pinnatifidis; pinnis longis; pinnulis rhombeo-ovatis hinc illinc indentatis, basi connatis imis basalibus rhachi frondis insertis, semiellipticis, sed sequente cum pinnula connectis. Frondibus quæ dichotomæ sunt, pinnatifidis an pinnato-pinnatifidis; pinnis in portione indivisa locoque divisionis proximis, brevioribus; illis in ramis longioribus; pinnulis variantibus nunc oblique ovato-oblongis, nunc quadrato-ovatis, integris, an apice oblique truncatis an indentatis; in fronde pinnato-pinnatifida pinnulis imis basalibus etiam remotis et, in pinnis superioribus, rachi frondis adfixis; nervis partim ex uno, quasi mediano, media in parte basis ex rhachi eggrediente, furcatione repetita orientibus, nonnullis aliis directe ex rhachi eggredientibus, etiam furcatis."

In this diagnosis all the various forms of this species are included. According to it this species was of various sizes, now slender and of middling size, another time large and of strong growth; this depends, apparently, upon the age of the plant; the leaf is either simple or dichotomously divided. The simple fronds are pinnate-pinnatifid; pinnæ long; pinnules rhomboid ovate, here and there dentate on the upper margin, at the base they are connate; the lowest basal pinnules are semielliptic and inserted already on the rachis of the leaf, but still they are connected with the next leaflet of the pinna, so that it has to be considered as belonging to the pinna itself. The dichotomous fronds are either pinnatifid or pinnate-pinnatifid; this depends on the state of development of the frond. In younger plants, when they are dichotomous, each branch represents a pinna, which is only pinnate, that is, it has only pinnules, which, however, also occur in the lower portion, below the point of division; if they are larger forms, each of the branches represents a chief rachis, which bear pinnæ with pinnules, and which also continue below the point of division; in these lower parts, however, the pinnæ are shorter, while higher up they become much longer. The pinnules are of rather a varying form, sometimes obliquely ovate-oblong, sometimes quadrately ovate, entire or obliquely truncate above or indentate; in the pinnate-pinnatifid frond the lowest basal pinnules are also removed somewhat down the rachis, especially in the pinnæ closest to the top.

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[*] Palaeontographica, Suppl. III, Lief. II: Rhät. Pflanzen und Thierreste in den Argentinischen Provinzen, Tab. I, Figs. 10–16.

The venation is quite characteristic; the greater portion of the veins, which altogether are not very numerous, originate, as it were, from a common point in the base of the leaflet by repeated furcation; besides this, there are other veins coming out directly from the rachis of the pinna, which also are repeatedly forked. The dichotomy of the leaf is pretty frequent; it was observed by all the describers of this species, so it would follow that it is rather the rule than the exception.

Locality and Horizon.—This species occurs at various localities on various horizons:—

(*a*) In the Hawkesbury rocks, at Mt. Victoria, New South Wales (Plates XXIII, XXIV, XXV).

(*b*) In the Wianamatta Shales at Clarke's Hill, near Cobbitty, New South Wales (Pl. XXVI, Figs. 1, 2).

(*c*) In the Upper Mesozoic beds at Ipswich (Pl. XXIX, Figs. 1, 2), and Tivoli Mines (Mr. Carruthers figures—compare our Pl. XXVIII, Fig. 8), in Queensland; in the Jerusalem Basin, Tasmania (Pl. XXIX, Figs. 3, 4, 5).

Although the above diagnosis was destined to comprise most of the varieties of this very variable form, yet some other forms have been described since.

THINNFELDIA ODONTOPTEROIDES, *var.* FALCATA, *Ten. Woods.*

Thinnfeldia odontopteroides, var. *falcata*, Tenison Woods, *loc. cit.*, 1883, p. 107, Pl. 8, f. 1.

Obs.—The only difference from *T. odontopteroides* appears to be that the pinnules become long and falcate as they ascend the rachis.

Locality and Horizon.—Abundant at the Rosewood Scrub, about ten miles from Ipswich, Queensland (Upper Mesozoic).

Mr. Johnston (*loc. cit.*, 1885) distinguishes still two other varieties of *Thinnfeldia odontopteroides*, viz.:—

THINNFELDIA ODONTOPTEROIDES, *var.* SUPERBA, *Johnston.*

Thinnfeldia odontopteris, var. *superba*, Johnston, *loc. cit.*, 1885, p. 30.

Locality and Horizon.—In shales associated with the coal seam at Spring Bay, Tasmania.

THINNFELDIA ODONTOPTEROIDES, *var.* OBTUSIFOLIA, *Johnston.*

Thinnfeldia odontopteroides, var. *obtusifolia*, Johnston, *loc. cit.*, 1885, p. 29.

Locality and Horizon.—In shales at the foot of Spring Hill, Tasmania.

THINNFELDIA TRILOBITA, *Johnston.*

Thinnfeldia trilobita, Johnston, *loc. cit.*, 1885, p. 30.

Sp. Char.—"Frond bipinnate; (?) pinnæ linear elongate, dichotomously divided; pinnules pinnatifid, coriaceous, oblique, opposite, truncately narrowly strap-shaped, invariably terminating in three variably shaped digits or lobes, the central one of which is usually the most prominent; veins obscure, not well defined; adjacent margins of pinnules run closely parallel to each other, joining in a rounded sinus near to the rachis, giving to the latter the appearance of a broad marginal wing; rachis strong and grooved; average breadth of pinna, 15 millimetres; average length of pinnules, 9 mm.; breadth, 4½ mm."

Obs.—As in Mr. Johnston's paper, there are no figures of the described specimens, it is quite impossible to form any idea of the relations of the fossils.

Locality and Horizon.—In shales beneath the coal seam at Spring Bay, Tasmania (Upper Mesozoic).

THINNFELDIA MEDIA, *Ten. Woods.*

Thinnfeldia media, Tenison Woods, *loc. cit.*, 1883, pp. 102, 103, Pl. 6, f. 1.

Obs.—Mr. Tenison Woods compares it with *Thinnfeldia indica*, although, as far as can be judged from the figure, the relation appears to me very small.

Locality and Horizon.—Found in the sandstones at Dubbo, New South Wales, where it is associated with *Thinnfeldia odontopteroides*. Tenison Woods considers these sandstones to be the same as the Hawkesbury Sandstone (Mesozoic); also at Spring Hill, Tasmania.

Genus—ODONTOPTERIS, *Brongniart.*

Obs.—In the same family with *Thinnfeldia* used also to be placed the genus *Odontopteris*; but, while *Thinnfeldia* is now classed with the Lomatopterideæ, *Odontopteris* is the type of a special family. *Odontopteris* is believed to be especially a Carboniferous fossil, but the present form from Australia is from a higher horizon.

ODONTOPTERIS MICROPHYLLA, *M'Coy.*

Odontopteris microphylla, M'Coy, Ann. Mag. Nat. Hist., 1847, Vol. XX, p. 147.
" " Feistmantel, *loc. cit.*, 1878, p. 89.
" " Tenison Woods, *loc. cit.*, 1883, p. 108.

Sp. Char.—Fronde bipinnata; pinnis alternis, obliquis, angustis; pinnulis alternis, obliquis, ad basin subconnectis, obtuce ellipticis, longitudine basis latitudinem æquante, nervis secundariis indistinctis.

"Bipinnate; pinnæ alternate, oblique, narrow, about three lines wide and two inches long; pinnules alternate, oblique, slightly connate at base, obtusely elliptical, their length equalling the width of their base, no midrib; secondary venation indistinct."

Locality and Horizon.—Common in the fine sandstone of Clarke's Hill, New South Wales; Wianamatta Shales (Mesozoic).

ODONTOPTERIS MACROPHYLLA, *Milne Curran.*

Odontopteris macrophylla, Milne Curran, On some Fossil Plants from Dubbo, New South Wales (Proc. Linn. Soc. N.S. Wales, 1885, Vol. IX.*)

Locality and Horizon.—In the Hawkesbury Sandstone at Dubbo, New South Wales (Lower Mesozoic).

[* Pt. 2, p. 250, t. 9, f. 8.—R.E., jun.]

Tasmania; on the Clarence River, in New South Wales, where it occurs together with *Tæniopteris Daintreei*; at Ipswich and the Darling Downs, Queensland.

ALETHOPTERIS CURRANI, *Ten. Woods.*

Alethopteris Currani, Tenison Woods, *loc. cit.*, 1883, p. 113, Pl. 6, f. 4.

Obs.—According to Mr. Tenison Woods the fossil appears to have belonged to the division *Pecopteris acrostichides*, Schimper, in which the frond, which is pinnate and bipinnate, has the pinnules adherent by the whole base and confluent. The veins are slender, costa disappearing near the apex, the veins forking. Of the sori nothing is known, and the relations may have been, as in other members of the genus, with *Asplenium*. In this case the secondary pinnules only are seen in the apex of what has been probably a portion of the frond. The pinnules are falcate oblique, oblong lanceolate, slightly serrated at the upper edge, rounded at the apex into a blunt point, nearly opposite, adherent by the whole base, confluent. Costa of the pinnules emerging from the rachis at a very acute angle; veins few, conspicuous, forking once, the venules reaching the margin at the re-entering angle of the serrations, apical pinnules acute. Length of fragment, 25; greatest width, 15; length of longest pinnule, 10; width of base, 6; all millimetres.

Locality and Horizon.—In the Ballimore Coal-field, New South Wales; Hawkesbury rocks (Mesozoic).*

ALETHOPTERIS CONCINNA, *Ten. Woods.*

Alethopteris concinna, Tenison Woods, *loc. cit.*, 1883, p. 112, Pl. 9, f. 1.

Sp. Char.—"Frond bipinnate, with rather long, rounded and obtuse leaflets; costa faint; veins numerous and close, emerging at an acute angle, forking once; the venules very close and parrallel, reaching the margin."

Locality and Horizon.—Not quite certain—either from Ballimore Mine, Talbragar River, or from Ipswich, Queensland.

Genus—PECOPTERIS, *Brongniart.*

Obs.—I do not think any of the true species of this genus occur in Australia, the one here alluded to being very doubtful.

[* See note attached to *Sphenopteris crebra*, p. 90, *antea.*—R.E., jun.]

ALETHOPTERIS AUSTRALIS, *Morris*, sp.

Pl. XXVII, Figs. 3, 3*a*.

Pecopteris australis, Morris, *loc. cit.*, 1845, p. 248, Pl. VIII, figs. 1, 2, 2*a*.
" " M'Coy, Prodr. Pal. Victoria, Dec. II, 1875, pp. 16, 17, Pl. XIV, f. 3.
Alethopteris australis, Feistmantel, *loc. cit.*, 1878, p. 109, Pl. XIV, figs. 1, 1*a*.
" " Tenison Woods, *loc. cit.*, 1883, p. 111.

Sp. Char.—Fronde bipinnata; pinnis obliquis, alternis; pinnulis obliquis, subfalcatis, subalternantibus, lanceolato-ovatis, apice obtusiusculis, basim versus sensim dilatatis, tota basi adnatis subcontiguis, margine plerumque integris, nonnunquam subsinuosis; nervo medio tenero, subflexuoso, ad apicem subevanescente; nervis secundariis obliquis, e basi nonnunquam etiam ad marginem, dichotomis; habitu Asplenii; fructificatione ignota.

"Frond bipinnate; pinnæ oblique, alternate, rather distant; pinnules thin, falcate and rather obtuse, oblique and somewhat incurved, more or less adnate to the rachis, and sometimes decurrent, dilate at the base or auriculate; costa slightly flexuous, evanescing towards the apex; veins oblique, bifurcate or dichotomous."

Obs.—This species was one amongst three which were described by Prof. Morris from the Jerusalem Basin, Tasmania, and which were said to come from strata underlying marine beds. But, as already said, the occurrence of *Alethopteris (Pecopteris) australis*, together with *Zeugophyllites* and *Pecopteris odontopteroides*, in marine beds could not be proved. On the contrary, *Pecopteris australis* is rather numerous in the Upper Mesozoic beds of Victoria, from whence Prof. M'Coy figured a good specimen in his Prodr. Pal. Victoria, 1875. According to Prof. M'Coy's opinion, this species can hardly be distinguished from Mr. Bean's *Pecopteris scarburgensis*, and which, according to Mr. Leckenby, stands between *Pecopteris insignis* and *Pecopteris ligata*. The only difference lies in the more pronounced denticulation towards the apex of the pinnules of the English species.

I myself find a rather strong relation with *Alethopteris indica*, Oldh., sp., from the Rájmahál beds (Lower Jurassic) in India. It is also related to *Pecopteris (Alethopteris) Lindleyana* from the coal beds (Damuda Series) of India. The relation consists chiefly in the circumstance that they all belong to the group of *Alethopteris whitbyensis*, Bgt., sp. *(Asplenium whitbyense*, Heer.)

Locality and Horizon.—In the Upper Mesozoic beds at Bellarine, near Geelong, and in the Barrabool Hills, in Victoria; Jerusalem Basin, in

"Frond dichotomous, pinnate; rachis moderate in size, terete; pinnæ remote, alternate, obovate-elongate, inciso-lobate; nerves indistinct."

Obs.—I have placed this fossil with the genus *Gleichenia* especially on account of the dichotomy of the leaf and the form of the leaflets. The veins are rather indistinct, the fossil being preserved only as an impression in a fine-grained, yellowish-greenish sandstone. It appears to me, from the faint venation, that the frond differs from *Thinnfeldia odontopteroides.*

Locality and Horizon.—On the specimen there was no other indication but "Wianamatta beds," but I would judge that it came from Clarke's Hill, New South Wales (Mesozoic).

GLEICHENIA LINEATA, *Ten. Woods.*

Gleichenia lineata, Tenison Woods, *loc. cit.*, 1883, p. 130, Pl. 3, f. 6; Pl. 8, f. 2.

Sp. Char.—"Frond small, coriaceous, with a strong thick rachis, dichotomously divided, pinnate, bipinnate; pinnules entire, linear, attached by almost the whole of the base, but slightly contracted at the lower portion, somewhat distant, not decurrent. Upper edge convex, lower slightly concave, but in a few pinnules divided into deep rounded lobes;* apex acute, emerging from the rachis at an angle of about 35 degrees; veins not prominent, costa not forking and quite persistent to the apex; veins not very visible in any of the specimens, but apparently grouped and numerous, emerging at an acute angle and bifurcating. There appear to be two venules emerging at the very base of the pinnulæ. Rachis conspicuously marked with a single deep dark median groove."

Obs.—Mr. Tenison Woods regards the species as closely related with *Gleichenia flabellata*, R. Br.

Locality and Horizon.—At Rosewood Scrub, near Ipswich, Queensland, preserved in a red ferruginous oxide in purple slate (Upper Mesozoic).

Genus—MERIANOPTERIS, *Heer*, 1877.

(Flora Fossilis Helvetiæ, p. 88.)

Obs.—This genus was originally established by Prof. Heer, to include two fossil ferns from the Mesozoic rocks of Switzerland. I have described one species from the Middle Gondwána horizon, Raniganj Group, in India, which differed from the former especially by its much larger size, and by some other characters. This Indian species was also observed amongst the Australian fossils by Mr. Tenison Woods.

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* "But this may be a monstrosity, as it is seen on a few pinnæ of only one specimen." (Note by Mr. Tenison Woods.)

MERIANOPTERIS MAJOR, *Feistmantel.*

Merianopteris major, Feistmantel, The Fossil Flora of the Gondwána System, 1881, Vol. III, pt. 2, p. 83, Pl. XIX, figs. 9-11.
„ „ Tenison Woods, *loc. cit.*, 1883, p. 114, Pl. 6, f. 2.*

Sp. Char.—Fronde magna, tripinnata; pinnis secundariis elongato-latiusculis, apicem versus parum angustatis, pinnati-sectis vel pinnatifidis; pinnulis vel lobis apice rotundatis, tenerrimis, nervo medio distincto, incurvato; nervis secundariis duobus imis ex parte inferiore nervi mediani eggredientibus dichotomis, in arcum acutissimum connatis; ceteris superiorem partem pinnulæ versus e nervo mediano angulo acutissimo eggredientibus, dichotomis, flexuosis.

"Frond large, tripinnate; secondary pinnæ somewhat broadly elongate, only a little narrowed towards the apex, pinnatisect or pinnatifid; pinnules or lobes rounded at the apex and very thin-leaved; middle vein (costa) distinct, somewhat curved at the apex; the two lowermost veins divide on emerging and join with the similar veins of the adjoining leaflets into a pointed arch, while the others are placed more towards the upper portion of the pinnules, passing out at a very acute angle from the costa, and are also dichotomous and somewhat flexuous."

Locality and Horizon.—In the Ballimore Coal-field beds, New South Wales (Mesozoic).

Genus—TÆNIOPTERIS, *Brongniart.*

Obs.—The old genus, *Tæniopteris*, has been greatly subdivided of late into various other types, which represent as many different genera, and which are all generally included in the family Tæniopterideæ. The differences of the various genera are based upon the different form of the leaves, the different mode of venation, the state of fructification, if known, and the possible relations with living ferns. According to this, there are distinguished by Prof. Schimper, in Zittel's "Handbuch der Palæontologie," the following genera:—*Tæniopteris*, Brgt.; *Macrotæniopteris*, Schimper; *Palæovittaria*, Feistm.; *Oleandridium*, Schimp.; *Angiopteridium*, Schimp.; *Marattiopsis*, Schimp.

[*Also Fig. 3, the enlargement of a pinnule.—R. E., jun.]

In Australia there are amongst the fossil plants representatives of three of the above genera.

TÆNIOPTERIS DAINTREEI, *M'Coy.*

Pl. XXVII, Figs. 4, 5; Pl. XXVIII, Figs. 6, 6*a*.

Tæniopteris Daintreei, M'Coy, Prodr. Pal., Vict., 1875, Dec. II, p. 15, Pl. XIV, figs. 1, 2.
„ „ Feistmantel, *loc. cit.*, 1878–1879, p. 110, Pl. XIV, figs. 2, 3; p. 169, Pl. XII, figs. 5, 5*a*.
„ „ Tenison Woods, *loc. cit.*, 1883, p. 117.

Sp. Char.—Fronde (pinnulis ?) longissima, lineari parallela, coriacea marginibus integra; nervo medio crasso; nervis secundariis sub-angulo recto an suberecto eggredientibus, plurimis furcatis differentibus in locis longitudinis nervorum.

"Frond very long, linear, parallel-sided, substance thick, edges straight; costa very strong, veins extending at right angles from the midrib to the lateral margins, a few straight and simple, the greater number once forked at a variable distance between the midrib and lateral margin."

Obs.—This species was originally described by Prof. M'Coy from Victoria; later on Mr. Carruthers described a *Tæniopteris* from Queensland, which, although rather different from M'Coy's type specimens, he yet identified with M'Coy's species. Mr. Tenison Woods, however, thinks that this Queensland form is so far different as to deserve of being treated as a new species.* But as it so happened there was amongst the specimens sent to me by Mr. Clarke the true *T. Daintreei* from Queensland, while the one figured by Mr. Carruthers will have to be treated as a different species.

From the size and form of the leaf, and from the distribution of the veins, I should think that this species ought to be placed in the genus *Angiopteridium*, Schimp.

Locality and Horizon.—At Cape Paterson, Barrabool Hills, and on the Wannon River—all in Victoria (M'Coy mentions it also from Tasmania, but this is doubtful)†; at Southgate, Clarence River, in New South Wales; at the Talgai Diggings, on the Condamine River, in Queensland (Upper Mesozoic).

[* The first to suggest the separation of the Queensland fern from the typical *T. Daintreei* was Prof. M'Coy. (See Prod. Pal. Vict., Dec. 2, p. 16.)—R. E., jun.]

[† I am not aware that Prof. M'Coy ever referred to this plant as a Tasmanian species. Prof. Feistmantel has evidently obtained his information from Mr. R. M. Johnston's Paper so frequently quoted in this Memoir. Therein, under *Tæniopteris Daintreei*, the latter says:—"Referred to by M'Coy (Dec. 2, Pal. Vic., p. 15) as occurring 'in the same mass of stone with *Glossopteris Browniana*, in one of the Tasmanian specimens,' therefore locality probably Mersey Coal Basin (?)." By placing the words from 'in' to 'specimens,' inclusive, in inverted commas, Mr. Johnston clearly wishes them to be understood as a *verbatim* quotation from M'Coy's Decade. They are, however, nothing of the kind, and M'Coy makes no reference to *T. Daintreei* occurring in Tasmania on the page quoted. The fossil which M'Coy there speaks of as in company with *Glossopteris Browniana* is the *Pecopteris australis*, Morris.—R. E., jun.]

TÆNIOPTERIS CARRUTHERSI, *Ten. Woods.*

Pl. XXVIII, Fig. 7.

Tæniopteris Daintreei, Carruthers in Daintree, *loc. cit.*, 1872, p. 355, Pl. XXVII, f. 6.
" " Feistmantel, *loc. cit.*, 1878, p. 110, Pl. XIV, f. 4.
Tæniopteris Carruthersi, Tenison Woods, *loc. cit.*, 1883, p. 117.

Sp. Char.—"Frond simple (?), broad, linear; costa somewhat thick, veins leaving it at an acute angle, then passing out at right angles to the margin, once or twice dichotomously divided."

Obs.—This is the *Tæniopteris Daintreei* described by Carruthers from Queensland.

Locality and Horizon.—At the Tivoli Coal Mine, near Ipswich, Queensland (Mesozoic).

TÆNIOPTERIS TASMANICA, *Johnston.*

Tæniopteris tasmanica, Johnston, *loc. cit.*, 1885, p. 33.

Sp. Char.—"Frond simple, broadly strap-shaped, not obovate; midrib moderately strong; veins well defined, exceedingly close and numerous, parallel, emerging from midrib at an acute angle, and immediately bending and reaching margin at a slight angle upwards. About one nerve in ten simply furcate near middle of wing; about twenty-four nerves in the space of half-an-inch; length unknown, breadth about 46 millimetres."

Locality and Horizon.—Common in the shales at the foot of Spring Hill, Tasmania (Mesozoic).

TÆNIOPTERIS MORRISIANA, *Johnston.*

Tæniopteris Morrisiana, Johnston, *loc. cit.*, 1885, p. 33.

Sp. Char.—"Frond simple, narrowly strap-shaped; costa fine; veins numerous, parallel, one in six simply furcate, emerging and radiating outwards at a moderately acute angle to margin; length unknown; breadth about 16 millimetres; nerves fully 1 millimetre apart."

Mr. Johnston thinks it allied to the specimen figured as *Tæniopteris Daintreei* by Mr. Carruthers, now *T. Carruthersi.*

Locality and Horizon.—In a greyish-white shale below a four feet coal seam, near Longford, Tasmania.

Genus—ANGIOPTERIDIUM, *Schimper*, 1869.

(Traité Pal. Vég., Tome I, p. 602.)

Obs.—The affinities of this genus are Mesozoic. Several species have been described from the Indian Gondwána System. One of these has also been observed by the Rev. Mr. Tenison Woods amongst the fossils in Australia.

ANGIOPTERIDIUM ENSIS, *Oldham*, sp.

Stangerites ensis, Oldham and Morris, Fossil Flora of the Rájmahál Hills, 1862, p. 35, Tab. VI, figs. 8, 9, 10.

Angiopteridium ensis, Schimper, Traité Pal. Vég., 1869, I, p. 606.

„ „ Feistmantel, Jurassic (Liassic) Flora of the Rájmahál Group, in the Rájmahál Hills (Palæontologia Indica, 1877, Ser. II, Pl. 2, p. 45 [97]).

„ „ Tenison Woods, *loc. cit.*, 1883, p. 119.

Sp. Char.—Fronde pinnata, pinnis elongatis, lineari-ovatis, ad apicem acuminatis; mediano nervo crasso, rapide diminuente; nervis secundariis prominentibus sæpe furcatis, bis vel tri-dichotomis, e mediano nervo obliquiter eggredientibus.

"Frond pinnate, pinnæ elongate, linear ovate, acuminate at the apex; costa thick, rapidly diminishing; veins prominent, often forked once or twice, emerging obliquely from the costa."

Locality and Horizon.—At Rosewood, near Ipswich, Queensland (Upper Mesozoic).

Genus—MACROTÆNIOPTERIS, *Schimper*.

Obs.—It appears that the forms of this genus are most prominently Mesozoic, although the Permian *Tæniopteris abnormis*, Gutb., was, in 1876, placed by Mr. Sterzel[*] with *Macrotæniopteris*.

I have described a good many species from the Indian Gondwána System (Upper and Middle Division), and there is one good species known from Australia.

MACROTÆNIOPTERIS WIANAMATTÆ, *Feistmantel.*

Pl. XXVII, Figs. 1, 2.

Macrotæniopteris wianamattæ, Feistmantel, *loc. cit.*, 1878, p. 107, Pl. 13, f. 2.

„ „ C. S. Wilkinson, Ann. Rep. Dep. of Mines, N.S.W., 1879, p. 215, Pl. V.

„ „ Tenison Woods, *loc. cit.*, 1883, p. 118.

Sp. Char.—Fronde elongato-obovata, simplici, basi attenuata, apice ? ; rhachide crassa, lineata ; nervis secundariis subangulo graduum 20–25 eggredientibus, confertis, 0·6–0·8 mm. distantibus (prope rhachim), marginem versus dichotomis, tenuibus.

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[*] Neues Jahrb. f. Min. Geol. u. Pal., 1876.

"Frond elongately obovate, simple, base attenuate, apex (?); rachis thick, grooved or striated; veins emerging at an angle of 20 to 25 degrees, close, near the rachis 0·6 to 0·8 mm. apart, slender, dichotomous towards the margin."

Obs.—I have compared this species with *Tæniopteris (? Macrotæniopteris) superba*, Saporta (Vég. Triassic et Jur., Pal. franç., p. 439, Tab. 61, 62), from the French Rhät.

Locality and Horizon.—Gib Tunnel, near Bowral, New South Wales (Wianamatta beds); also Kenny's Hill (Tenison Woods, Lit. No. 54).

Mr. Tenison Woods, in his paper "On the Wianamatta Shales" (see Lit. No. 54), quotes it also from Mt. Victoria, New South Wales; Hawkesbury rocks (Mesozoic).

Genus—CYCADOPTERIS, *Zigno.*

Obs.—Only quite recently a fossil fern has been figured from the Wianamatta Shales and referred doubtfully to the above genus. But unfortunately the venation is rather indistinctly preserved, so that it is rather difficult to decide whether the reference is correct or not.

The genus has been established by Count de Zigno for certain ferns of the Jurassic (including Liassic) formation.

CYCADOPTERIS (?) SCOLOPENDRINA, *Ratte.*

Cycadopteris (?) scolopendrina, F. Ratte, *loc. cit.*, 1887, p. 1081, Pl. XVI, f. 5.

Obs.—As already mentioned, the specimen is not very favourably preserved, so that the venation is not distinctly seen, and one cannot decide with certainty whether it is a *Cycadopteris* or a *Lomatopteris*, Schimp.

Locality and Horizon.—Mr. Ratte does not mention any special locality, but describes the fossil only as coming from the Wianamatta Shales, New South Wales (Mesozoic).

Now follows a group of fossil ferns which contains especially two genera, which are of great importance and interest in connection with the

Coal deposits of India and Australia. They have a reticulated venation, and we can, together with the third genus, classify them as follows :—

Venation reticulated; frond simple or pinnatifid.

(A) With a midrib:
  - (*a*) Midrib conspicuous, frond simple—*Glossopteris.*
  - (*b*) Midrib evanescing towards the apex; frond pinnatifid—*Sagenopteris.*

(B) No midrib, or indistinct: frond simple (?)—*Gangamopteris.*

Genus—GLOSSOPTERIS, *Brongniart*, 1822.

(Histoire des Végétaux Fossiles, p. 222.)

Gen. Char.—Fronde simplici (an digitata ?), stipitata vel in petiolum decurrente, integerrima, lanceolata, spathulata vel oblongato-obovata; rhachide (costa) semper distincta, crassa an subcrassa, usque ad apicem producta, rarissime apicali in portione subevanescente; nervis secundariis sub-angulo variante ex rhachide eggredientibus, dichotomis anastomosantibus, retia diversa, totam folii superficiem explentia, formantibus. Fructificatione, ut videtur tribus in modis nota.—(Feistmantel.)

Obs.—The chief character of this leaf, in comparison with the others of the above group, especially of *Gangamopteris*, is the presence of a distinct midrib, from which the veins pass out, forming nets. This genus is the oldest known from the Coal deposits of Australia and India, as already, in 1828, it was established by Al. Brongniart, when three forms were described, two from India and one from Australia. Since then it has been found to be very numerous in Australia and India, and has also been met with at other places.

It has a rather wide geological distribution; for if we only take Australia and India into consideration, we find that it passes from Lower Carboniferous into Jurassic, and there is besides one species which in Europe is quoted from Tertiary beds.

The distribution is about as follows :—

(*a*) In Australia.—One species was quoted together with *Otopteris ovata* by M'Coy from Arowa, but it was shown that this *Otopteris* is really

Rhacopteris inæquilatera, the same as occurs at Smith's Creek, near Stroud, and that, therefore, Arowa also belongs to the Lower Carboniferous, so that here would be the oldest *Glossopteris.*

The next horizon, where *Glossopteris* is more numerous, is the so-called Lower Coal Measures, between the Upper and Lower Marine beds, which, as shown before, represent the Middle and Upper Carboniferous horizon. This is in New South Wales and Queensland.*

The chief development of *Glossopteris* lies in the Newcastle beds or Upper Coal Measures, which are probably equivalents of the Permian Epoch, and which lie *above* the ice-borne conglomerate. It appears to occupy a similar position in the Lower Coal beds in Tasmania with *Glossopteris* and *Gangamopteris*, as has been shown before, when discussing the general relations of the plant beds in that province.

(*b*) In India.—Here the range of *Glossopteris* is much higher. *Glossopteris* begins, as has been ascertained by me beyond any doubt, in the Talchir shales *above* the Talchir boulder bed (ice-borne ?). It is more frequent in the Karharbári beds, the coal-bearing portion of the Talchir division, which, as shown before, probably represents the Permian Epoch. It reaches its highest development, however, in the Damuda division, and there in the highest group (Rániganj-Kámthi), and it passes on into the Panchet division, both divisions forming what I now call Middle Gondwánas, which probably represent the Trias. But we find it also in one instance at least in the Upper Gondwánas (Jurassic), viz., in the Jabálpur Group of the Sátpara Basin, where it was noticed by myself.

(*c*) In Africa.—*Glossopteris* occurs in Southern Africa in the Karoo Formation, in beds above the Dwyka Conglomerate, and which on the whole correspond with the Damuda division in India.

(*d*) In Russia.—In a paper,† entitled "Der Klinische Sandstein," Prof. Trautschold describes a fern with the name *Glossopteris solitaria.* The form of the leaf agrees well with that of *Glossopteris*, and Prof. Trautschold

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[* With the exception of M'Coy's locality—Arowa, in the Lower Carboniferous, or Stroud Group—the lowest horizon at which *Glossopteris* is known to occur is the Lower Marine Group. The plant was found at Stony Creek, West Maitland, by Mr. Geological-Surveyor David in these beds, and again by Mr. B. Dunstan in the Lower Marine Group at Wollongong. In Queensland *Glossopteris* occurs not only in the Upper or Fresh-water Group of the Bowen River Coal-field, the probable equivalents of our Newcastle Coal Measures, but also in the Middle or Marine Group of the same field, representing the Upper Marine Group of New South Wales. (Etheridge, *Proc. R. Phys. Soc., Edinburgh*, 1880, V, p. 326).—R.E., jun.]

† Nouv. Mém. Soc. Imp. Nat. Moscou, Vol. XIII, p. 221, Pl. XIX, f. 1.

distinctly mentions an anastomosis of the veins in the lower portion of the leaf, though only faintly indicated. The rock whence the leaf was obtained is of Cretaceous age.

(*e*) Asia Minor.—From the coal beds between Eregli and Amasry in Asia Minor the genus *Glossopteris* has been mentioned twice,[*] but as no figures or descriptions were given it is impossible to form any idea of the correctness of the observation. Moreover, in Tchihatcheff's great work, "Asie Mineure," 1867, wherein the plants were described by A. Brongniart, no mention is made of this genus, so that this case must be regarded as doubtful.

(*f*) Italy.—In their "Monograph of the Tertiary Flora of Novale,"[†] Messrs. Visiani and Massalongo have described a *Glossopteris apocynophyllum* (p. 206, and Pl. I, Fig. 1). If the drawing correctly represents the specimen, its character would well coincide with those given in the diagnosis of the genus *Glossopteris;* and as it is from Tertiary beds, this would represent the highest range of the genus.

A few remarks have still to be made about the fructification. One kind of fructification appears to be with certainty known, that is, in some Indian specimens. There I have observed round sori, placed in longitudinal rows between the margin and the midrib, which, perhaps, indicates a relation with *Polypodium*, on leaves, which, if judged from the venation only, would represent three species, viz.:—*Glossopteris communis*, Feistm. (with narrow nets throughout); *G. indica*, Schimp. (broad nets close to the midrib, becoming narrower towards the margin), and *G. Browniana*, Bgt. (polygonal nets throughout the leaf).

This kind of fructification, occurring also on leaves of *Glossopteris Browniana*, is rather important, because in some Queensland specimens of this species Mr. Carruthers thought he could observe a fructification "in the form of linear sori running along the veins, and occupying a position somewhat nearer to the margin of the frond than to the midrib."

This kind of fructification would necessarily indicate a different plant, an *Anthrophyum*; and thus I gave it as my opinion, which, I think, cannot be denied or ridiculed by any serious man of science, "that there is every possibility that the Australian and Indian fossils, quoted as *Glossopteris Browniana*, are really not only distinct species, but also belong to distinct genera."

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[*] Schlehan Vers. einer geogn. Beschr. d. Gegend zw. Amasri und Tyrla-Asy., 1852. Spratt, Quart. Journ. Geol. Soc., 1877.

[†] Mem. Acad. di Torino, 2d Ser., Vol. XVII.

The above statement had of course much greater weight at the time it was made, viz., when the real position and relation of the boulder beds in India, Australia, and Africa was not established with certainty. At that time I tried to demonstrate the possibility of the difference of the Newcastle beds in Australia, and the Damuda Group in India, by this possible difference of the fructification of leaves, which were thought to be identical.

It appears to me that I have observed a third kind of fructification, viz., along the margin, in *Glossopteris angustifolia*, Bgt., from India.

GLOSSOPTERIS BROWNIANA, *Brongniart*.

Pl. XIII, Fig. 1; Pl. XVI, Figs. 3, 4; Pl. XVII, Figs. 1, 3, 4, 5 (?) 7; Pl. XX, Fig. 2.

G. Browniana, Brongniart, Prodrome, 1828, p. 54.
„ Brongniart, Hist. Vég. Foss., 1828, p. 223, Tab. 62, f. 2 (f. 1).
„ Morris, in Strzelecki, *loc. cit.*, 1845, p. 247, Pl. VI, figs. 1, 1*a*.
„ M'Coy, *loc. cit.*, 1847, p. 156.
„ Dana, *loc. cit.* 1849, pp. 716, 717, Pl. 12, f. 13.
„ Schimper, Traité Pal. Vég., 1869, Vol. I, pp. 645, 646.
„ Carruthers, in Daintree, *loc. cit.*, 1872, p. 354.
„ Feistmantel, Foss. Flora Australiens, 1878, 1879, pp. 90 and 154, with figs.
„ Feistmantel Flora of the Damuda and Panchet Divisions, &c., 1887, pp. 102, 103, with figs.
„ Tenison Woods, *loc. cit.*, 1883, p. 122.

Sp. Char.—" Foliis mediocribus, petiolatis, oblonge-ovatis, apice obtusis; nervo medio crasso, usque ad apicem producto; nervis secundariis retia polygonalia, totam superficiem tegentia, marginem versus paulum angustiora, formantibus; fructificatione incerte nota."

Obs.—This is the species originally described by Al. Brongniart in two varieties, viz., var. *australasica* (from Australia) and var. *indica* (from India), so that Brongniart himself considered the two forms as different, the more, as in the var. *indica* he observed a fructification in form of rounded sori. Schimper separated both forms, yet further forming both into species, designating the Australian as *G. Browniana*, and the other as *G. indica*.

Later on the two forms were simply identified, and thus the Indian and Australian coal deposits were correlated. I have, however, shown that in India there really occur leaves with a net venation like that in *G. Browniana*, but that at least in some of these leaves there was observed a fructification like that in *G. indica*, while, if we refer to Mr. Carruthers' descriptions, it would appear that in some of the Australian *G. Browniana* a different sort of fructification was observed.

This point has, however, only a botanical interest now, but it is to be mentioned that the observation is not quite beyond any doubt, so that, at least some of the leaves of *Glossopteris Browniana* in India and Australia may be considered to be of the same nature.

Locality and Horizon.—This species in Australia is known (*a*) from the Lower Coal Measures in New South Wales, where it was found at Greta (Pl. XIII, Fig. 1). Also in Queensland it appears to occur in a similar horizon (Middle and Upper Palæozoic). (*b*) From the Upper Coal Measures, Newcastle beds, in New South Wales, at several localities. Similarly in Queensland, and in the Mersey beds in Tasmania (? Permian).

GLOSSOPTERIS BROWNIANA, *var.* PRÆCURSOR, *Feistmantel.*

Pl. XIII, Figs. 5-7.

G. Browniana, var. *præcursor*, Feistmantel, *loc. cit.*, 1878, p. 79, Pl. V, figs. 5-7.
" " Tenison Woods, *loc. cit.*, 1883, 126.

Var. Char.—Foliis parvulis, spathulato-elongatis; costa distincta ad apicem subevanescente; nervis secundariis sub-angulo acuto egredientibus, arcuatis furcatis, anastomosantibus, retia subæqualia, elongato-polygonalia, formantibus.

Obs.—This variety was established by myself, before I knew the real *G. Browniana* from the same horizon, but even now I think it can well be distinguished as such.

Locality and Horizon.—In the Lower Coal Measures, at Stony Creek, New South Wales (Middle and Upper Carboniferous).

GLOSSOPTERIS AMPLA, *Dana.*

Pl. XIX, Figs. 1, 2.

Glossopteris ampla, Dana, *loc. cit.*, 1849, p. 717, Pl. XIII, f. 1.
" " Feistmantel, *loc. cit.*, 1878, p. 91, Pl. XI, f. 2; Pl. XII, f. 7.
" " Tenison Woods, *loc. cit.*, 1883, p. 124.

Sp. Char.—Fronde maxima, late ovata, integra undulata obtuse acuminata; nervo medio crasso, ad apicem extenuante; nervis secundariis anguste confertis, longe reticulatis, retia ad marginem longissima.

"Frond very large, widely ovate, entire, undulating, obtusely acuminate, costa thick, extending to the apex; veins extremely fine and close, forming long reticulations, longest towards the margin."

Obs.—This species appears to occupy a position between *G. indica*, Schimp., and *G. communis*, Feistm., from India.

Locality and Horizon.—In the Newcastle beds (Upper Coal Measures) at Newcastle (the above figures) and Illawarra (? Permian); also in the Mersey beds, Tasmania.

GLOSSOPTERIS CLARKEI, *Feistmantel.*

Pl. XIII, Figs. 4, 4*a*.

Glossopteris Clarkei, Feistmantel, *loc. cit.*, 1878, p. 79, Pl. V, figs. 4, 4*a*.
" " Tenison Woods, *loc. cit.*, 1883, p. 126.

Sp. Char.—Foliis elongato-obovatis, obtuse acuminatis; rhachi distincta, mediolineata; nervis secundariis parallelis, dichotomis, maxima in parte folii liberis, Tæniopteridis instar; ad marginem solum bis-terque anastomosantibus, retia rhombeo-polygonalia formantibus.

"Leaves oblong-ovate, obtusely acuminate; costa distinct, grooved in the middle; veins parallel, dichotomous, free for the greater part of the leaf, like a *Tæniopteris*, anastomosing only at the margin twice or thrice, forming a rhombo-polygonal network."

Obs.—This species is named after the late Rev. W. B. Clarke, who is so well known in connection with Australian Geology. The chief character lies in the circumstance that the veins form nets only close to the margin.

Locality and Horizon.—In the Lower Coal Measures (below Upper Marine beds) at Rix's Creek, New South Wales (Middle and Upper Carboniferous).

GLOSSOPTERIS COMMUNIS, *Feistmantel.*

Pl. XVII, Figs. 2, 6.*

Glossopteris communis, Feistmantel, Gondwána Flora, 1881, Vol. III, pt. 2, p. 98, and figs.

Sp. Char.—Foliis magnis variantibus; costa crassa; apice acuto; nervis secundariis sub-angulo 30°–50° exeuntibus, retia oblonga angustissima formantibus.

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* [On Pl. XVII, Figs. 2 and 6 are called *Glossopteris densinervis*, n sp., but the Stratigraphical and Geographical Distribution Table does not contain such a species, although *G. communis* is there catalogued.—R. E., jun.]

Obs.—This is the commonest species in India. The leaves are large, varying in size; the midrib is thick; the apical portion prolonged and the apex generally pointed; the secondary veins pass out at an angle of 30°–50°, and form long and very narrow anastomoses, which are only slightly broader close to the midrib.

Locality and Horizon.—I observed this species in the shales of the Mersey Coal beds in Tasmania (from there no figures are given). I also think that the two specimens on Pl. XVII, Figs. 2, 6, represent this species, although at first I thought that they might represent another type. They are from Bowenfels, New South Wales, from the Newcastle beds (? Permian).

GLOSSOPTERIS CORDATA, *Dana*.

Glossopteris cordata, Dana, *loc. cit.*, 1849, p. 718, Pl. XIII, f. 5.
" " Feistmantel, *loc. cit.*, 1878, p. 92.
" " Tenison Woods, *loc. cit.*, 1883, p. 124.*

Sp. Char.—Fronde basim versus distincte cordata, lobis rotundatis; nervo medio crasso; nervis secundariis ad basim reversis, ex medio divergentibus, nitide reticulatis, retia anguste oblonga formantibus.

"Frond distinctly cordate towards the base, lobes rounded; costa thick; veins reversed at the base, diverging from the costa, neatly reticulate, with narrow oblong interspaces."

Locality and Horizon.—Newcastle beds (Upper Coal Measures), at Illawarra, New South Wales.

GLOSSOPTERIS ELEGANS, *Feistmantel*.

Pl. XII, Figs. 3, 3*a*.

Glossopteris elegans, Feistmantel, Foss. Flora von Australiens, Nachtrag, 1879, p. 155, Pl. VIII, figs. 2, 2*a*.
" " Tenison Woods, *loc. cit.*, 1883, p. 125.

Sp. Char.—Fronde mediocri, oblonge-spathulata, mediocostata; costa superiore in parte evanescente, ibidemque areolis bijugis, inferioribus oblongis, superioribus brevioribus pentagonalibus substituta; nervis e costa, superiore in parte ex areolis medianis sub-angulo acuto eggredientibus, furcatis, anastomosantibus, retia oblonga formantibus.

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* At p. 124, *loc. cit.*, Mr. Tenison Woods states that the four species *G. ampla*, *G. reticulata*, *G. elongata*, and *G. cordata* were by myself considered "to be only varieties." This is a misunderstanding. In my short paper (Journ. R. Soc. N. S. Wales, 1880) I have, to save space, named them together in one paragraph, but I did not quote them as varieties of each other.

"Frond of medium size, oblong spathulate with a costa which becomes merged in the tissue above, but it is formed in the lower part of pairs of areolar spaces, which are oblong; higher up are similar spaces, but shorter and somewhat polygonal. Veins arising at an acute angle from the median areolar spaces, dichotomous, anastomosing and forming an oblong network."

Obs.—This is a most interesting form, especially from the peculiar formation of the midrib; and there is no other Indian or Australian similar species.

Locality and Horizon.—At Greta, New South Wales (Lower Coal Measures), Middle and Upper Carboniferous.

GLOSSOPTERIS ELONGATA, *Dana.*

Glossopteris elongata, Dana, *loc. cit.*, 1849, p. 717, &c.
" " Feistmantel, *loc. cit.*, 1878, p. 92.
" " Tenison Woods, *loc. cit.*, 1883, p. 124.

Sp. Char.—Fronde anguste elongata, lanceolata, ad basim attenuata, nervo medio crassiusculo, distincto; nervis secundariis nitide reticulatis.

"Frond narrowly elongate, lanceolate, attenuate at the base; costa somewhat thick, distinct; veins neatly reticulate."

Locality and Horizon.—In the Upper Coal Measures at Newcastle, New South Wales (? Permian).

GLOSSOPTERIS GANGAMOPTEROIDES, *nov. sp.*

Pl. XX, Fig. 4.

Obs.—The above figured specimen was originally mentioned only as *Glossopteris*, sp., but a renewed examination shows that the costa does in the apical portion dissolve into the secondary veins, while it is altogether rather thin. Thus it resembles somewhat the genus *Gangamopteris*, on account of which I now distinguish it by the above specific name.

Locality and Horizon.—In the Newcastle beds (Upper Coal Measures) at Bowenfels, New South Wales (? Permian).

GLOSSOPTERIS LINEARIS, *M'Coy.*

Pl. XVI, Figs. 1, 2; Pl. XIX, Figs. 3, 4; Pl. XX, Fig. 6.

Glossopteris linearis, M'Coy, *loc. cit.*, 1847, p. 151, Pl. IX, figs. 5, 5*a*.
" " Feistmantel, *loc. cit.*, 1878, p. 91, and figs.
" " Tenison Woods, *loc. cit.*, 1883, p. 123.

Sp. Char.—Foliis elongatis, angustis, subparallelis; nervo medio crasso; nervis secundariis tenerris anastomosantibus.

"Leaves long, narrow, with nearly parallel sides; costa very distinct; veins fine, forming fine nets."

Obs.—Prof. M'Coy compares this form with the Indian *Glossopteris angustifolia*, to which it has really a certain resemblance; but I do not think it would be possible to identify these two forms, for it appears to me that I have observed in *G. angustifolia* a marginal fructification; and also the veins in this latter are much more oblique, as is shown in the specimen figured on Pl. XVI, Fig. 5, which I think represents *Glossopteris angustifolia*, Bgt.

Locality and Horizon.—In the Upper Coal Measures at Newcastle (Pl. XVI, Figs. 1, 2; Pl. XX, F. 6), Bowenfels (Pl. XIX, Figs. 3, 4), New South Wales (? Permian). The specimen (Pl. XVI, Fig. 5) is from Blackman's Swamp.

GLOSSOPTERIS PARALLELA, *Feistmantel.*

Pl. XVIII, Figs. 2, 3, 4.

Glossopteris parallela, Feistmantel, *loc. cit.*, 1878, p. 93, Pl. IX, figs. 2, 3, 4.
" " Tenison Woods, *loc. cit.*, 1883, p. 125.

Sp. Char.—Fronde longissima, simplici, elongato-obovata (apice ignoto); costa distincta, medio lineata; nervis secundariis sub-angulo 40° (in parte inferiore) et 20° (in parte superiore) egredientibus, dichotomis, parallele-anastomosantibus, retia distincta, oblonge polygonalia, ad marginem angustiora formantibus.

"Frond very long, simple, elongately ovate, apex unknown; costa distinct, grooved in the middle; veins emerging at an angle of 40° in the lower portion and at an angle of 20° in the upper portion of the frond, dichotomous, parallel, but anastomosing, forming a distinct oblongly-polygonal net, the meshes of which are narrower towards the margin."

Obs.—This is a very peculiar and characteristic leaf, especially from the venation, and from the form of the network, the meshes of which appear as it were parallel.

Locality and Horizon.—In the Upper Coal Measures at Bowenfels, New South Wales (? Permian).

GLOSSOPTERIS PRIMÆVA, *Feistmantel.*

Pl. XIII, Figs. 3, 3*a*.

Glossopteris primæva, Feistmantel, *loc. cit.*, 1878, p. 79, Pl. V, figs. 3, 3*a*.
" " Tenison Woods, *loc. cit.*, 1883, p. 126.

Sp. Char.—Foliis spathulatis; costa crassa lineata; nervis secundariis sub-angulo 20–30 graduum eggredientibus, parallelis, dichotomis, anastomosantibus, retia polygonalia, ad rhachim latiora brevioraque, marginem versus longiora angustioraque formantibus.

"Frond spathulate; costa thick, grooved; veins emerging at an angle of from 20 to 30 degrees, parallel, dichotomous, anastomosing, forming a polygonal network, which is wider and shorter near the rachis, narrower and longer near the margin."

Obs.—This is one of those species which also occur below the Upper Marine beds.

Locality and Horizon.—In the Lower Coal Measures at Greta, New South Wales (Middle and Upper Carboniferous).

GLOSSOPTERIS RETICULUM, *Dana.*

Glossopteris reticulum, Dana, *loc. cit.*, 1849, p. 717, Pl. XIII, f. 2.
" " Feistmantel, *loc. cit.*, 1878, p. 92.
" " Tenison Woods, *loc. cit.*, 1883, p. 124.

Sp. Char.—Fronde magna oblonge-elliptica; latitudine tertiam partem longitudinis non excedente, apicem versus gradatim attenuante; nervis secundariis usque ad marginem late reticulatis.

"Frond large, oblong-elliptical, the width not exceeding a third part of the length, gradually attenuate towards the apex; veins broadly reticulate to the margin."

Locality and Horizon.—In the Upper Coal Measures at Newcastle, New South Wales (? Permian).

GLOSSOPTERIS SPATHULATO-CORDATA, *nov. sp.*

Pl. XX, Figs. 5, 7, 8.

Obs.—The above specimens have already been figured in my original work (1878, *loc. cit.*, p. 93, Pl. XII, Figs. 3, 5, 6), where I designated them as the developmental state of some *Glossopteris*. As, however, it is not certain to which species they may belong, and as similar leaves also occur at a similar horizon in Tasmania, I thought it advisable to distinguish them by a separate name, without, however, attempting to construct a diagnosis, referring to the figures only.

Locality and Horizon.—In the Upper Coal Measures at Newcastle and Bowenfels, New South Wales, and in the Mersey Coal beds, Tasmania (? Permian).

GLOSSOPTERIS TÆNIOPTEROIDES, *Feistmantel.*

Pl. XVIII, Figs. 1, 1*a*.

Glossopteris tæniopteroides, Feistmantel, *loc. cit.*, 1878, p. 92, Pl. IX, figs. 1, 1*a*.
" " Tenison Woods, *loc. cit.*, 1883, p. 125.

Sp. Char.—Fronde simplici speciosa, oblonge ovato-spathulata, ad basim attenuata; rhachide valida, lineata; nervis secundariis sub-angulo subrecto eggredientibus, primo aspectu nervationi Tæniopteridis similantibus. Sub lente retia oblonga, angusta, oblique-acute parallelogramma aut indistincte polygonalia exhibentibus.

" Frond simple, elegant in form, oblong ovato-spathulate, attenuate at the base; costa strongly striate, or grooved; veins emerging at nearly a right angle, giving at first sight the appearance of a *Tæniopteris*. Under the glass the venation is seen to form an oblong, narrow, obliquely-acute, parallel network, which is sometimes indistinctly polygonal."

Locality and Horizon.—In the Upper Coal Measures at Blackman's Swamp, New South Wales (? Permian).

GLOSSOPTERIS WILKINSONI, *Feistmantel.*

Pl. XX, Figs. 1, 1*a*.

Glossopteris Wilkinsoni, Feistmantel, *loc. cit.*, 1878, p. 92, Pl. XIII, figs. 1, 1*a*.
" " Tenison Woods, *loc. cit.*, 1883, p. 125.

Sp. Char.—Fronde angustissima, subparallela, teniæfolia, costa distincta, ad apicem producta; nervis secundariis subhorizontalibus, dichotomis, anastomosantibus, plurimis semel, apicemque versus retia oblonga formantibus, nonnullis retibus minoribus ad rhachidem marginemque versus positis.

Obs.—This is a long, narrow leaf, with a distinct midrib with once o twice anastomosing secondary veins. I cannot say whether it was a single leaf or otherwise.

Locality and Horizon.—In the Newcastle beds at Blackman's Swamp, New South Wales (? Permian).

Genus—GANGAMOPTERIS, *M'Coy.*

Cyclopteris, M'Coy, Ann. Mag. Nat. Hist., 1847, Vol. XX, p. 148.
Gangamopteris, M'Coy, Prodr. Pal. Victoria, 1875, Dec. II, p. 11.
„ Feistmantel, Austr. Flora, *loc. cit.*, 1878, p. 101.
„ Feistmantel, The Fossil Flora of the Gondwána System, 1879–1881, pp. 12 and 102, with many figures.
„ Tenison Woods, *loc. cit.*, 1883, pp. 126-128.

Gen. Char.—Fronde simplici (an impare pinnata ?), forma variabili, nunc ovali, latiuscula, nunc obovato elongata, basi attenuata, amplexicauli an subauriculata, nunc lanceolato-spathulata, truncata; nervo medio (distincto) nullo, omnibus nervis ex basi radiantibus anastomosantibus, retia varia formantibus; fructificatione adhuc ignota.

Obs.—The first species of this genus was described, in 1847, by Prof. M'Coy as *Cyclopteris (?) angustifolia*;* but M'Coy has rightly observed that, though the venation has the general distribution like a *Cyclopteris*, yet it differs by constant anastomosing of the veins. Later he formed the genus *Gangamopteris*,† and in 1875 he illustrated it especially from specimens from the Bacchus Marsh Beds in Victoria, where representatives of this genus are the only fossils known.

But the same genus also occurs in the Newcastle beds in New South Wales; and it is also very frequent in the Mersey beds in Tasmania, where it is found together with species of the genus *Glossopteris.* Under quite similar circumstances it occurs in India in the Talchir Shales, and in the Karharbári coal beds.

It was especially upon this occurrence that I have, in my original work on the Australian Flora (1878, p. 101), based the correlation of the plant beds in India and Australia (Victoria and New South Wales). It was about the same as that now arrived at from the geological relations. It will not be without interest if I repeat it here.

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* From Guntawang, near Mudgee, New South Wales (Upper Coal Measures).

† [The correct date of this genus is 1861. It was first proposed in a paper by Prof M'Coy—"A Communication made by the Rev. W. B. Clarke, &c., on Professor M'Coy's *new Tæniopteris*" (*Trans. R. Soc. Vict.*, 1860 [1861], p. 107, *note.*)—R. E., jun.]

India.	Victoria.	New South Wales.
DAMUDA SERIES :— *Phyllotheca*, somewhat rare; *Vertebraria*, *Glossopteris*, very numerous; *Schizoneura*, frequent.		
TALCHIR GROUP (with Karharbári beds) :— *Gangamopteris* — prevailing form, one identical with one in Victoria. *Voltzia*.	BACCHUS MARSH SANDSTONE :— *Gangamopteris*, very numerously developed.	NEWCASTLE BEDS :— *Phyllotheca*, numerous; *Vertebraria*, *Glossopteris*, numerous; *Gangamopteris*, one identical with one in Victoria; no *Schizoneura*; no *Voltzia*.
No Marine beds.	No Marine beds.	MARINE BEDS with Fauna :— *Glossopteris*, at Stony Creek, Rix's Creek, Anvil Creek, Greta, &c.; *Rhacopteris*, *Cyclostigma*, *Lepidodendron*, at Smith's Creek, Port Stephens, Arowa, &c.; *Lepidodendron*, at Goonoo Goonoo, &c.

Only later, when the so-called boulder-bed* in the Hawkesbury beds was made known, I have adopted another mode of correlation, viz., that of the Hawkesbury boulder bed with a similar one in the Bacchus Marsh beds, and also in the Talchir beds; but I have sufficiently shown that the correlation is no more tenable, but that the Bacchus Marsh conglomerate must be correlated with a similar one in the marine beds in New South Wales, and thus the above table is now again re-established.

The chief character of a *Gangamopteris* lies in the distribution of the veins. They are, speaking generally, distributed radiarily, but form anastomoses, and we can thus say that a *Gangamopteris* is a *Glossopteris* without a midrib.

There are several species known from Australia, as follows : —

GANGAMOPTERIS ANGUSTIFOLIA, *M'Coy.*

Cyclopteris angustifolia, M'Coy, *loc. cit.*, 1847, Vol. xx, Tab. xix, figs. 3, 3*a*.
Gangamopteris angustifolia, M'Coy, Prodr. Pal. Victoria, 1875, Dec. II, p. 11, Tab. XII, f. 1, Tab. XIII, figs. 2, 2*a*.
" " Feistmantel, Rec. Geol. S. India, 1876, Vol. IX, Pt. 4, p. 138.
" " Feistmantel, Foss. Flor. Austr., 1878, p. 102.
" " Tenison Woods, *loc. cit.*, 1883, p. 127.

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* [See footnote, p. 28.—R. E., jun.]

Sp. Char.—Foliis longissimis, lineari-lanceolatis, subæquilateralibus, ad apicem sensim attenuatis, basi subconstricta; nervis confertis, media ex parte radiantibus, dichotomis, omnibus anastomosantibus.

"Frond very long, narrow, unequal sided, very gradually tapering towards the apex from the widest portion near the base, base slightly contracted; veins close, radiating from the middle of the base, dichotomous and anastomosing."

Locality and Horizon.—In the Newcastle beds at Guntawang, near Mudgee, New South Wales (? Permian); in the Bacchus Marsh beds, above the conglomerate, in Victoria (? Permian); and in the Talchir and Karharbári beds in India, also above the boulder-bed (? Permian); also in the Mersey beds, Tasmania.

GANGAMOPTERIS CLARKEANA, *Feistmantel.*

Pl. XX, Fig. 3.

Glossopteris Clarkeana, Feistmantel, *loc. cit.*, 1878, p. 93, Pl. xv, f. 9.
" " Tenison Woods, *loc. cit.*, 1883, p. 127.

Sp. Char.—Fronde spathulato rotundata, mediocri, coriacea, integra symmetrica; ex parte superiori rotundata basim versus valve attenuata; nervis e basi radiantibus, crassiusculis, distantibus dichotomis, retia oblonga formantibus.

"Frond spathulately rounded, of medium size, coriaceous, entire, symmetrical, rounded above, but gradually tapering towards the base, whence radiate the somewhat thick and distant veins, forking and forming an oblong network."

Obs.—This species reminds us somewhat of M'Coy's *Gangamopteris spathulata*, but the present leaf is much more rounded in its upper part, and is more coriaceous; the veins are thicker and more distant.

Locality and Horizon.—At Bowenfels, New South Wales, in the Upper Coal Measures (? Permian).

GANGAMOPTERIS CYCLOPTEROIDES, *Feistmantel.*

Gangamopteris cyclopteroides, Feistmantel, Gondwana Flora, 1879, Vol. III, Pt. 1, p. 12, &c., and figs.
" " Feistmantel, Gondwana Flora, 1886, Vol. IV, Pt. 2, p. 30, &c.

Sp. Char.—Fronde oblonge ovali symmetrica an subobliqua integra, rhachide non obvia, nonnullis nervis crassioribus solum indicata; nervis e basi radiantibus (Cyclopteridis instar), anastomosantibus, retia longiuscula ac latiuscula media in folii parte, sed angustissima marginem versus formantibus (Glossopteridis instar); basi attenuante, amplexicauli.

Obs.—This is the commonest form in the Talchir and Karharbári beds in India, and it there represents M'Coy's *Gangamopteris obliqua*, from the Bacchus Marsh beds in Victoria.

Locality and Horizon.—I have recognized the same species amongst the fossils from the Mersey Coal beds in Tasmania.

In the same beds there occurred also two varieties of the same species, which are also frequent in the Talchir and Karharbári beds in India, viz.:—

GANGAMOPTERIS CYCLOPTEROIDES, *var.* ATTENUATA.

Feistmantel, *loc. cit.*, 1879, p. 14, et figs.

GANGAMOPTERIS CYCLOPTEROIDES, *var.* SUBAURICULATA.

Feistmantel, *loc cit.*, 1879, p. 13, et figs.

These forms now aid considerably in correlating the Mersey beds with the Talchir and Karharbári beds.

GANGAMOPTERIS OBLIQUA, *M'Coy.*

Gangamopteris obliqua, M'Coy, *loc. cit.*, 1875, p. 13, Tab. XII, figs. 2-4.
" " Feistmantel, *loc. cit.*, 1878, p. 102.
" " Tenison Woods, *loc. cit.*, 1883, p. 127.
" " Johnston, *loc. cit.*, 1885, p. 37.

Sp. Char.—Fronde lata, inæquilatera, obliqua, basim versus sensim attenuante; basi oblique truncata sessili.

"Wide, inequilateral, oblique, subtrigonal, widest near the broadly distal end, gradually tapering towards the base, which is not petiolate, but obliquely truncated, with a moderately wide sessile base of attachment; length commonly about 4 or 5 inches, width near apex about 3½ inches, width near base commonly about 9 lines."

Locality and Horizon.—"This is the most variable and common of the three forms abundant in the sandstone quarries of Bacchus Marsh, Victoria" (? Permian). It is also found in the Mersey coal beds, and at Porter Hill, near Hobart, Tasmania (? Permian).

GANGAMOPTERIS SPATHULATA, *M'Coy.*

Gangamopteris spathulata, M'Coy, *loc. cit.*, 1875, p. 12, Pl. XIII, figs. 1 1*a*.
" " Feistmantel, *loc. cit.*, 1878, p. 102.
" " Tenison Woods, *loc. cit.*, 1883, p. 127.
" " Johnston, *loc. cit.*, 1885, p. 37.

Sp. Char.—Fronde spathulata, symmetrica, æquilaterali, obtuse acuminata, ad basim angustata.

"Spathulate, symmetrical, equal sided, semi-elliptically pointed above, tapering towards the base to a slender petiole; length 4½ inches, width about 1½ to 2 inches."

Locality and Horizon.—In the Bacchus Marsh beds, Victoria, but the rarest species (? Permian).

GANGAMOPTERIS, sp.

Gangamopteris, sp., Clarke, Rev. W. B. On the Occurrence and Geological Position of Oil-bearing Deposits in N. S. Wales (Quart. Journ. Geol. Soc., London, 1866, pp. 439–448).

Obs.—In the above paper (see Lit., No. 25) Mr. Clarke mentioned at two places in the Upper Coal Measures the occurrence of *Gangamopteris*. I have already mentioned the case, but shall point to it here again.

On the Nattai River there occurs cannel coal within the strata of the Upper Coal Measures; and from some of the shales of the coal seams Mr. Clarke procured *Glossopteris*, and M'Coy's *Gangamopteris*. Similarly there occurs cannel coal also at Reedy Creek, belonging to the Upper Coal Measures,* and in the shales above it there were *Vertebraria*, *Glossopteris*, and *Gangamopteris*, M'Coy.

It appears that these forms of *Gangamopteris* are such as occur in Victoria, although no species is named; so that this is again one point more for the correlation of the Newcastle beds (Upper Coal Measures) and Bacchus Marsh beds (above the conglomerates).

Genus—SAGENOPTERIS, *Presl.*

Obs.—This is also a fern with a net venation, but the frond is three- or quadri-lobate, the single leaflets are deciduous and variable in their form.

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* [Mr. C. S. Wilkinson desires it to be known that the measures developed at these localities, Nattai River and Reedy Creek, are the Lower Coal Measures and not the Upper, more recent surveys than those of the late Rev. Mr. Clarke having shown this to be the case.—R. E., jun.]

There is a midrib generally only in the lower portion of the leaflets; the other veins form anastomoses.

Of this genus I have described two species from amongst the Australian fossils, one of which, however, remains somewhat doubtful.

SAGENOPTERIS RHOIFOLIA, *Presl.*

Pl. XXVIII, Figs. 1-5.

S. rhoifolia, Presl in Sternberg, Vers. einer Fl. d. Vorw, 1838, II, p. 165, Tab. XXXV, f. 1.
„ Schenk, Fl. d. Grenzschichten, 1867, p. 57, Tab. XII, figs. 1-6.
„ Feistmantel, Foss. Fl. Austr., *loc. cit.*, 1879, p. 170, Pl. XII, figs. 1-4, 7.
„ Tenison Woods, *loc. cit.*, 1883, p. 128.

Sp. Char.—Foliis petiolatis 3-4 lobatis, segmentis integris, sessilibus, obtusis, lateralibus inæqualibus, mediis sub-brevioribus; nunc mediis oblongis, lateralibus obovatis, nunc omnibus elongatis, lanceolatis, nunc rotundatis basi contractis; nervo primario e basi crassiore apicem versus evanescente, secundariis subangulo acuto eggredientibus, marginem attingentibus, repetito dichotomis, anastomosantibus, retia prope rhachim latiora, marginem versus angustiora formantibus.

The leaf is petiolate, 3-4 lobate; the leaflets entire obtuse, the lateral ones unequal, somewhat shorter than the middle ones; the form of the leaflets rather varying; there is a middle vein only in the basal portion, higher up it merges into the leaf; the secondary veins pass out at an acute angle, are repeatedly dichotomous, and form anastomoses broader in the middle and narrower towards the margin.

Obs.—Amongst the fossils which were sent to me by the late Rev. W. B. Clarke, there were also the above figured specimens. I do not think there can be any doubt as to their belonging to the genus *Sagenopteris*, and they are most closely related to the species *S. rhoifolia*, so that I think I am justified in including the Australian specimens under the above species.

Sagenopteris rhoifolia occurs both in Rhætic and Liassic strata in Europe. In Queensland, where the above specimens were found, I think it may partly indicate the latter formation; it occurred together with *Tæniopteris Daintreei*, and *Otozamites* comp. *Mandeslohi*, Kurr.

Locality and Horizon.—In the Carbonaceous beds at Talgai (Talgai Diggings), on the Condamine River, Queensland; according to Mr. Tenison

Woods, also at Darling Downs, near Toowoomba, in Queensland (Upper Mesozoic).

SAGENOPTERIS TASMANICA, *Feistmantel.*

Pl. XXIX, Figs. 6, 6*a*.

Sagenopteris tasmanica, Feistmantel, *loc. cit.*, 1878, p. 111, Pl. XV, f. 10.
" " Tenison Woods, *loc. cit.*, 1883, p. 129.
" " Johnston, *loc. cit.*, 1885, p. 39.

Sp. Char.—Fronde composita, digitata (?), lobis linearibus, ad apicem attenuatis; nervo medio maxima in parte distincto, apicem versus subevanescente; nervis secundariis sub-angulo acuto eggredientibus, furcatis, semel anastomosantibus.

Obs.—This is the only specimen which I am acquainted with of this kind. There appears little doubt that both leaflets belong to one leaf, which in that case would be a digitate, and I think trilobate leaf. The single leaflets are linear, attenuate at the apex. The midrib, however, is quite distinct in the greater part of the leaflet, though disappearing in the apical portion. The secondary veins pass out from it under an acute angle, forming, as can be seen from the specimen, a single anastomosis.

The specimen resembles somewhat *Sagenopteris Phillipsi*, L. and H., of the English Oolite, but the possibility is not excluded that it belongs to another type.

Locality and Horizon.—In the Carbonaceous beds of the Jerusalem Basin, Tasmania (Upper Mesozoic).

POSITION DOUBTFUL.

CAULOPTERIS ADAMSI, *Feistmantel.*

Pl. XXI, Figs. 1, 2.

Caulopteris (?) Adamsi, Feistmantel, *loc. cit.*, 1878, p. 93, Pl. XII, figs. 1, 2.
" " Tenison Woods, *loc. cit.*, 1883, pp. 132, 133.

Obs.—The above figured specimens appear to me to be fragments of a fern trunk, with large scars, most probably of fallen leaves. These large scars appear to be spirally disposed, are transversely oblong-oval and covered with minute vascular cicatrices.

The specimen is hardly sufficiently complete to decide its nature and systematical position with absolute certainty; but supposing it to be, what it most probably is, a fragment of a fern trunk, and, taking the disposition of the scars to be quincuncial, I thought it would be more correct to place this specimen with the genus *Caulopteris*, as there are not sufficient characters for placing it anywhere else, or for making it the type of a new genus. I have given the following diagnosis:—

Sp. Char.—Trunco arboreo, mediocri, superficie cicatricibus ramorum (foliorum) notato; cicatricibus in quincunce (spiraliter) dispositis, transverse oblonge-ovalibus, paulum prominentibus, lateribus linea decurrente notatis; superficie interna cicatriculis parvulis vasalibus, 7 ad 8, repleta.

The species is named in honor of Mr. P. F. Adams, Surveyor-General of New South Wales, to whose eminent exertions is due the inauguration of the present Geological Survey of New South Wales.

Locality and Horizon.—In the Newcastle beds, at Newcastle, New South Wales (? Permian).

C.—LYCOPODIACEÆ.

Obs.—The various forms of this class of plants are largely represented in the true Coal Measures in Europe and America. In Australia they do not, however, occur within the coal seams, but in New South Wales in certain beds, even below the Lower Coal Measures, and in similar beds in Queensland, and partly also in Victoria.

Schimper, in Zittel's "Handbuch der Palæontologie" (1880, II Bd., 2 Lief.), divided the Lycopodiaceæ into two groups:—

1. Group—Isosporeæ; Family, Lycopodieæ.
2. Group—Heterosporeæ; Families—Selaginelleæ, Lepidodendreæ, Isoëteæ, Sigillarieæ.

All the Lycopodiaceæ to be described from Australia belong to the family Lepidodendreæ.

Genus—LEPIDODENDRON, *Sternberg.*

LEPIDODENDRON AUSTRALE, *M'Coy.*

Pl. I, Figs. 5, 6.

Lepidodendron australe, M'Coy, Prodr. Pal. Vict, 1874, Dec. I, pp. 37-39, Pl. IX.
" " Feistmantel, *loc. cit.*, 1878, p. 76, Pl. 13, figs. 3, 4.
" " Tenison Woods, *loc. cit.*, 1883, p. 134.

Sp. Char.—Trunco dichotomo, cicatricibus tecto, cicatricibus rhombeis, ad 4 lin. longis, et $3\frac{1}{2}$ lin. latis, tuberculo minimo, ovali, rarius media in parte, sæpius ad angulum superiorem posito fossulamque mediam exhibente, notatis. Ramis cicatricibus similibus tectis.

Stem dichotomous, having rhombic scars with straight thick boundaries, about 4 inches long and $3\frac{1}{2}$ inches wide, with a very small, oval, rounded, vascular cicatrix, rarely near the middle, more usually excentric towards the upper angle, showing in the middle a shallow sulcus. Branches are covered with similarly formed scars, of course somewhat smaller.

Obs.—This form belongs, according to Graf zu Solms-Laubach,[*] to the section of Lepidodendreæ called *Bergeria*[†]. Prof. M'Coy brings this species in very close relation with *Lepidodendron tetragonum*, Geinitz, from the Carboniferous of Saxony, so that these two can hardly be distinguished. For the same reason it is apparent that *L. australe* can in no way be correlated with *L. nothum*, Ung., from New South Wales and Queensland, for not only are the forms different, but there can, I think, be hardly any doubt that *L. nothum* is from beds below Lower Carboniferous, viz., from Devonian.

Locality and Horizon.—Common in the red and yellow micaceous Carboniferous Sandstone of the Avon River, Gippsland, five miles above Bushy Park, Victoria. This sandstone rests unconformably[‡] on the upturned edges of true Devonian rocks with characteristic fossils—(Lower Carboniferous).

LEPIDODENDRON NOTHUM, *Unger* [§].

Pl. I, Figs. 1–4; Pl. II, Figs. 1–6.

L. nothum, Unger, Fl. d. Oberdev. Schichten Thüringens (Denkschr. der Wiener Acad. d. Wiss., 1856, XI, p. 175, Tab. X, figs. 4–8).

„ Carruthers, Notes on Fossil Plants from Queensland (Quart. Journ. Geol. Soc., 1872, Vol. XXVIII, p. 350, Pl. XXVI).

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[*] Einleitung in die Palaeophytologie, p. 205, Leipzig, 1887.

[†] [Prof. McCoy pointed this out in his original description (Prod. Pal. Vict., 1874, I, p. 37).—R. E., jun.]

[‡] [This in no way agrees with the more recent observations of Mr. Reginald Murray, the Government Geologist of Victoria. In his recently issued "*Geology and Physical Geography of Victoria*" (8vo., Melbourne, 1887) he says (p. 67):—"Professor M'Coy expresses a strong opinion as to the Lower Carboniferous aspect of this fossil plant impression; and from my own observations I am inclined to believe that the beds in which it is found are among the uppermost of the group, and ***younger than, though conformable with,*** the Upper Devonian Beds of Freestone and Iguana Creeks." The italics are mine.—R. E., jun]

[§] [I am quite in accord with the already expressed opinion of Prof. McCoy (Prod. Pal. Vict. Dec. I, 1874, p. 38) on the probable identity of the Victorian ***Lepidodendron australe***, with the plants figured by Mr. Carruthers from Queensland, and it follows also by Dr. Feistmantel, as *L. nothum*, Unger. The evidence ***at present*** existing of the latter having existed in Australia in bye-gone times is of the weakest. As the reasons for this opinion are too long to be given here, I am preparing a separate paper on the subject, which will appear in due course. I may add, however, that Mr. Robert Kidston is of the same opinion (see Cat. Pal. Plant. Brit. Mus., 1886, p. 231).—R. E., jun.]

L. nothum, Feistmantel, Foss. Fl. Austr., *loc. cit.*, 1878, p. 69, Pl. I, figs. 1-5.
" Feistmantel, Nachtrag, *loc. cit.*, 1879, p. 141, Pl. I, figs. 1, 2.
" Tenison Woods, *loc. cit.*, 1883, p. 135.

Sp. Char.—"Scars of the leaf contiguous, rhombic, with a single and generally central vascular scar; leaves small, peltate and imbricate, on long slender petioles; fruit produced on the apices of the thick branches, a single sporangium, almost sessile, borne on the middle of the petiole of the leaf; roots stigmarioid."

Obs.—Unger, who established the species, had only some fragmentary specimens at his disposal. Mr. Carruthers united with it the fine specimens from Queensland, and the same species is also known from New South Wales from similar beds. Mr. Carruthers, in his above paper, gave full particulars as to the various relations of this plant from Queensland. For easier comparison I have reproduced on Pl. II, Figs. 3-5, three of his figures, which fully establish the identity of this species in Queensland and in New South Wales. The rhomboidal form of the scars in both cases is the same, and the species also belongs to the section *Bergeria*, Presl. At the same time, Mr. Carruthers compared the species with *Leptophlœum rhombicum*, Daws., from Upper Devonian rocks in North America, and believes both to be very closely related.

Mr. Carruthers described also fruit cones, which, however, I have not observed amongst the specimens from New South Wales. Mr. Carruthers describes the vascular scars also as central, while I have observed them only in the upper angle of the leaf scar. On Pl. II, Fig. 6 seems to be an impression of the stem after the bark has been removed.

Locality and Horizon.—This fossil has been collected at Mt. Wyatt, Canoona and the Broken River, in Northern Queensland. Mr. Tenison Woods quotes it from the Drummond Range. It occurs besides at Cowra, Canowindra, on the Lachlan River; Goonoo Goonoo Creek, on the Liverpool Plains; at the Back Creek Diggings, and on the Barrington River, in New South Wales.

According to the available literary sources this fossil comes from beds which have to be considered of Upper Devonian age, at least with regard to the geological sequence in New South Wales, where the Goonoo Goonoo beds underlie the Lepidodendron beds of Smith's Creek, Stroud, which themselves are Lower Carboniferous.

LEPIDODENDRON *comp.* DICHOTOMUM, *Sternberg.*

Pl. VI, Fig. 4.

Lepidodendron dichotomum, Clarke, Sedim. Form., New South Wales,* 1875, pp. 161, 162.
„ comp. *dichotomum*, Feistmantel, *loc. cit.*, 1878, p. 76.
„ *(?) dichotomum*, Feistmantel, Nachtrag, 1879, p, 151, Pl. VI, f. 5.

Obs.—This species was mentioned by the Rev. W. B. Clarke, from the Rouchel River, but no figure was given. Also in my original work on the Australian Fossil Flora, I could only mention it on the authority of Mr. Clarke; but later I received from him a fragmentary specimen of a Lepidodendroid plant, which, I think, shows the same leaf scars as they are seen in *L. dichotomum*; so that, in my supplement to the above work, I was able to give a figure of it under the above name. I have reproduced the figure here again, and I believe that, as far as can be judged from the fragment, its relation to *L. dichotomum* is quite evident.

Locality and Horizon.—The above specimen is from Smith's Creek, Stroud. Mr. Clarke quoted it, as already mentioned, from the Rouchel River, together with a *Lepidodendron rimosum*, which, however, I believe to belong to *L. Veltheimianum*, Stbg.

LEPIDODENDRON VELTHEIMIANUM, *Sternberg.*

Pl. X, Figs. 4, 5.

Lepidodendron Veltheimianum, Sternberg, Vers. einer Fl. d. Vorw., 1828, Vol. I, p. 12. Tab. LII, f. 2.
„ „ Heer, Foss. Flora der Bäreninsel, 1871.
„ „ De Koninck, Pal. Foss. Nouv.-Galles du Sud, 1877, Pt. 3, p. 142.
Lepidodendron rimosum, Clarke, *loc. cit.*, 1875, p. 17.
„ „ Feistmantel, *loc. cit.*, 1878, p. 77, Tab. v, f. 2.
„ „ Stur, Culmflora der Waldenburger Schichten, 1878, p. 269, *et seq.*
„ „ Tenison Woods, *loc. cit.*, 1883, p. 135.
„ „ Schimper, Traité Pal. Vég., Vol. II, p. 29.

Obs.—In my original work I gave the figure of a *Lepidodendron* of which Mr. Clarke had sent me a photograph, and which he marked as *L. rimosum*. I have quoted it as such, but have already given it as my opinion that the fossil might rather represent a form of the, so to say, polymorphous *Lepidodendron Veltheimianum*. Later I also found that Prof. de Koninck had previously quoted a *Lepidodendron Veltheimianum* without, however, mentioning a locality.

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* [Third edition.—R.E., jun.]

My opinion as to the relation of the said *Lepidodendron rimosum* to *L. Veltheimianum* was greatly confirmed by the above work of Mr. Dionys Stur, where there are numerous beautiful figures of *L. Veltheimianum*, amongst which I observe several which pretty well agree with our figure of the supposed *L. rimosum* (Pl. X, Fig. 5); also in a previous work of mine, on the Carboniferous Flora of Rothwaltersdorf, in Silesia, there is figured a specimen (Tab. XVII, Fig. 31) which strongly resembles the mentioned specimen from Australia. There appears, therefore, hardly any doubt that this Australian *Lepidodendron rimosum*, Corda, is really a variety of *L. Veltheimianum*, Stbg. Later I received another specimen (Pl. X, Fig. 4) which I have also identified with the same species.

The various relations of this species have been so exhaustively treated by Mr. Dionys Stur that nothing can be added from our specimens.

Locality and Horizon.—The supposed *L. rimosum* (Pl. X, Fig. 5) came from the Rouchel River, New South Wales. Mr. Clarke added: "With abundance of Lower Carboniferous marine forms." The other specimen is from the strata at Smith's Creek, Stroud, New South Wales (Lower Carboniferous). Mr. Tenison Woods quotes it from Bobuntungen, Drummond Range, Queensland.

KNORRIA STATE OF THE ABOVE SPECIES (?).

Plate X, Figs. 6, 7

Knorria-Zustand (?) *von Lepidodendron Veltheimianum* (?). Feistmantel, loc. cit., 1879, p. 152, Pl. V, figs. 2, 3.

Obs.—On Pl. X there are also figured two specimens of small stems, which are somewhat compressed, and are furnished with scars on the surface. These scars are impressions of an oblong form, and in their lower portion (I suppose having figured the specimens in their correct position) they are somewhat widened, while they are narrower in their upper part. The distribution on the stem is in a very steep quincunx. There appears hardly any doubt that these specimens belong to Lepidodendroid plants, but it is not quite easy to assign to them a definite place. They are either decorticated stems of some *Lepidodendron* (probably *L. Veltheimianum*), or else they represent the so-called *Knorria* state of the named species of *Lepidodendron*, although the scars here are hollow impressions.

Locality and Horizon.—In the Lower Carboniferous strata at Smith's Creek, Stroud; also in the Drummond Range, Queensland, in a similar formation (according to Mr. Tenison Woods).

LEPIDODENDRON VOLKMANNIANUM, *Sternberg.*

Pl. XI, Fig. 1.

Lepidodendron Volkmannianum, Stur, Culmfl. d. Ostrauer & Waldenburger Schichten, 1877, Tab. XVIII.

" " Feistmantel, Foss. Flora Austr. Nachtrag, 1879, p. 152, Pl. V, Fig. 1.

Obs.—The above is undoubtedly a fragment of a Lepidodendroid plant; the leaf scars are, however, somewhat strongly compressed and disfigured; but still their general outline can be made out, and in the upper part there can be distinctly seen a transversely rhomboidal cicatricula, with the lateral angles, however, turned down, joining the marginal line of the leaf scar.

If we compare the present form with others already known we arrive at the conclusion that it agrees best with *Lepidodendron Volkmannianum* of the Lower Carboniferous formation in Europe. I refer especially to Mr. Dionys Stur's work, amongst which, especially Pl. XXIII, Fig. 3*c*, reminds us very much of our specimen.

Locality and Horizon.—In the Lower Carboniferous beds at Smith's Creek, Stroud, New South Wales.

Genus—CYCLOSTIGMA, *Haughton.*

Cyclostigma, Haughton, Ann. & Mag. Nat. Hist., 1860, Vol. V, p. 444.
" Heer, Foss. Flora der Bäreninsel, 1871, p. 43.
" Schimper, Traité Pal. Vég., 1874, Vol. III, p. 530.

Sp. Char.—Trunco arboreo dichotomo, corticato; pulvinulis foliorum delapsorum minutis, subglobosis vel deplanato circularibus, vertice faveolatis tecto; impressione quorum circulari, an obovato circulari, profundiuscula, superna in parte tuberculo notata; foliis linearibus, medio carinatis.

Obs.—Amongst the Australian fossils there were various fragments of a Lepidodendroid plant, which, in their entire habit, agree with the characters of the above genus.

Mr. Carruthers also mentions, amongst the plants which Mr. Clarke had sent to the Geological Society of London, certain fragments which he could hardly distinguish from *Cyclostigma kiltorkense*, Hght.

The Rev. W. B. Clarke, in his paper on the "Sedimentary Formations of New South Wales" (1875, p. 162), says that he has found this *Cyclostigma* together with *Lepidodendron nothum*, Ung. (Carr.), and thus probably in Devonian rocks. I had also a fragment of this form from the Goonoo Goonoo beds, and others from another horizon.

CYCLOSTIGMA, sp.

Pl. II, Fig. 7.

Cyclostigma, sp., Feistmantel, *loc. cit.*, 1878, pp. 70, 71. Pl. I, f. 6.

Obs.—Amongst the specimens from Goonoo Goonoo, in New South Wales, from where *Lepidodendron nothum* was already described, there was also a small fragment of a stem, which undoubtedly belongs to the genus *Cyclostigma;* it is in the same rock as the above *Lepidodendron.* The surface shows small, oblongly-rounded impressions, which are pretty closely set, spirally arranged, and have in their upper part a similarly rounded tubercle. These impressions are of about the same size as those of *Cyclostigma killorkense*, Hght., but they are much more closely set; at the same time they are larger than in *Cyclostigma minutum*, Hght.

From the fragmentary condition of this specimen I did not assign to it a specific name, because, if more fragments were known, it might happen that it yet would have to be placed with *Cyclostigma killorkense*, Hght. On the other hand, it also shows some relation with the next species, except that the scars are more closely set. It is, however, not without interest, as, occurring together with *Lepidodendron nothum*, Ung., in beds which are lower than the strata at Smith's Creek, it would help to corroborate the view that *L. nothum* is really different from *L. australe*, M'Coy.

CYCLOSTIGMA AUSTRALE, *Feistmantel.*

Pl. XI, Figs. 2–4.

Cyclostigma australe, Feistmantel, *loc. cit.*, 1878, p. 76, Pl. IV, f. 3; Pl. V, f. 1.
„ „ Feistmantel, Suppl., 1879, p. 150, Pl. IV, f. 1.
„ „ Tenison Woods, *loc. cit.*, 1883, p. 138.

Sp. Char.—Trunco arboreo, ramis teneris, teretibus; pulvinulis subglobosis, faveolatis, approximatis, spiraliter dispositis, impressionibus oblonge ovalibus, profundiusculis, superna in parte tuberculo oblonge-ovato notatis.

"A tree trunk with slender terete branches, cushions or raised scars subglobose, pitted, approximate, spirally disposed, impressions oblong oval, rather deep, containing in their upper part an oblong ovate tubercle."

Obs.—This species differs from the figures of *Cyclostigma kiltorkense*, in Prof. Heer's above work, by having upon proportionally thinner branches (or stems) larger scars, which are also placed more closely together. With regard to the scars themselves, I could not find much difference between those of our specimens and those figured in Prof. Heer's work. Not feeling, however, certain about their identity, I proposed the above name for the Australian specimens, which also, as such, are of no small interest, especially in combination with the various species of *Rhacopteris* and *Lepidodendron*.

Locality and Horizon.—In the Lower Carboniferous beds at Smith's Creek, Stroud, New South Wales.*

There are two other specimens of Lycopodiaceous plants, which were described by Mr. Johnston, from Tasmania, and which I introduce here according to his descriptions.

TASMANITES PUNCTATUS, *Newton.*

Tasmanites punctatus, Johnston, *loc. cit.*, 1885, p. 40.
" " Johnston, Mem. Tasm. Botanists, 1874, p. 53.
" " Newton, Geol. Mag., 1875, Vol. II, pp. 337-342, Tab. X, figs. 1-9.
Tasmanites australis, Johnston, Pamphlet on Tasmanite, or Mersey Yellow Coal, Hobart, 1877, p. 6.

Sp. Char.—"Bituminous discs (sporangia) minute, rounded, usually flattened; surface, under microscope, ornamented with minute crateriform wings, in the centre of each of which occurs a fine pore or tube, communicating between the internal and external surface. These tubes are generally filled with blackish matter, and appear through the transparent coating of sporangium wall as hairs."

The peculiar nature of this organism was first described by Mr. Johnston in 1874 (*loc. cit.* above),† where it was described as the spore-cases of some ancient tree allied to the existing club-moss family.

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* [The presence of a *Cyclostigma* in the Smith's Creek beds, together with ***Rhacopteris*** and *Lepidodendron*, which Dr. Feistmantel admits to be of Lower Carboniferous age, rather weakens the great weight attached to the occurrence of this genus in the Goonoo Goonoo series, as assisting to prove the Devonian age of the latter.—R. E., jun.]

† [It was pointed out by other observers long before Mr. Johnston commenced his researches. The above bodies were shown to be sporangia by the late Prof. J. H. Balfour in 1857; by Dawson and Huxley they were termed spores, the former in 1871, the latter in 1873; and in 1874 the same bodies were figured under the term sporangia by Lyell. For a comparatively full synonymy and references see my "Catalogue of Australian Fossils."—R. E., jun.]

Locality and Horizon.—In the bituminous matter of the shale of the Lower Coal Measures of the Mersey, known as *Tasmanite, Yellow Coal,* or *Dysodile* (Permo-Carboniferous).

Lepidostrobus Muelleri, *Johnston.*

Lepidostrobus Muelleri, Johnston, *loc. cit.*, 1885, p. 41, figure.

Sp. Char.—"Strobilus or cone imperfect, oblong, narrow, cylindrical 4½ inches long and ⅞ inch in diameter; the longitudinal, striated cylindrical core of specimen, about half an inch in diameter, indicates that the central longitudinal cavity, or core, occupied fully one-third of the total diameter; bracteæ emerging from central axis at a slight descending angle, about 20 in number, from 4 to 6 mm. thick at base, and tapering downwards to margin, where they are from 2 to 3 mm. thick, and from which they suddenly bend upwards, and form long, thin, leaf-like, imbricating bracts, enclosing sporangia cavities or cells, of similar appearance and size to the enclosing bracteæ."

Locality and Horizon.—This unique and interesting specimen was discovered by Mr. Johnston in the so-called auriferous sandstones of Campania, which belong to the Mesozoic Coal Measures of Jerusalem, Tasmania.

CYCADEACEÆ.

Obs.—Remains of Cycadeaceæ are not very numerous amongst the Australian fossil plants, and, if we exclude the genus *Nöggerathiopsis,* there are hardly any known from New South Wales.

The fossil genera of Cycadeaceæ (leaves) are the following:—

Cycadites, Brgt. Ranges from Carboniferous to Cretaceous.
Podozamites, Fr. Braun. Rhætic to Wealden.
Zamites, Brgt. Lower Trias to Miocene.
Glossozamites, Schimper. ? Permian (Karharbári beds in India) to Cretaceous, where it is chiefly developed.
Otozamites, Fr. Braun. Rhætic to White Jura (Corallien).
Ptilophyllum, Morris. Jurassic.
Ctenophyllum, Schimper. Lias to Upper Jura.
Dioonites, Bornem. Rhætic to Lower Cretaceous.
Pterophyllum, Brgt. Upper Carboniferous to Wealden.

Anomozamites, Schimper. Rhætic and Jurassic. Sub-genus: *Platypterigium*, Schimper. Rhætic and Jurassic.
Ptilozamites, Nath. Rhætic.
Nilsonia, Brgt. Rhætic, Jurassic, and Cretaceous (?).
Sphenozamites, Brgt. Lias to Upper Jura.
Macropterygium, Schimper. Keuper.
Zeugophyllites, Brgt. Upper Mesozoic.

Genus—PODOZAMITES, *Fr. Braun.*

PODOZAMITES BARKLEYI, *M'Coy.*[*]

Podozamites Barkleyi, M'Coy, Prodr. Pal. Vict., Decade I, 1874, p. 33, Pl. VIII, figs. 1, 2, 5.
„ „ Feistmantel, *loc. cit.*, 1878, p. 111.
„ „ Tenison Woods, *loc. cit.*, 1883, p. 143.

Sp. Char.—Fronde 1·5″ ad 2·5″ lata; rhachide crassiuscula, pinnulis confertis, linearibus, obtuse acuminatis, basim versus subito contractis; basi contracta oblique insertis, subalternis vel fere oppositis; superficie conferte striatis, inferioreque in parte 10 ad 12 costulis longitudinalibus, equalibus, ad apicem subevanescentibus, notatis.

Obs.—This species is named after Sir Henry Barkley, late Governor of Victoria.

Locality and Horizon.—In the Bellarine beds between Geelong and Queenscliff, Victoria.[†]

PODOZOMITES ELLIPTICUS, *M'Coy.*

Podozomites ellipticus, M'Coy, *loc. cit.*, 1874, p. 35, Tab. VIII, f. 4.
„ „ Feistmantel, *loc. cit.*, 1878, pp. 111, 112.
„ „ Tenison Woods, *loc. cit.*, 1883, p. 144.

Sp. Char.—Fronde ad 2·3″ lata; rhachide crassa; pinnulis ellipticis, distantibus, latiusculis, coriaceis, plerumque 3 costulas, nonnunquam 11 minores exhibentibus, superficie conferte striatis; basi contractis, oblique insertis, subalternis vel fere oppositis.

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[*] [As it is not noted in the synonomy of this and the two following species, it may be well to state that they were quoted in the earlier publications of the Geological Survey of Victoria as characteristic fossils of the Bellarine series under the name of *Zamites*. The first figures appeared in "Reports relative to the Geological Survey of Victoria," 1861, A., No. 43, Pls. 3 and 4 (folio, Melbourne, 1862), and formed part of the late Mr. Richard Daintree's "Report on the Geology of Bellarine and Paywit, &c."—R. E., jun.]

[†] ["Impressions of fossil ferns" were obtained at a depth of 50 feet in Little's No. 2 bore at Bellarine. This may possibly be the locality of these Cycads.—R. E., jun.]

Obs.—This species reminds somewhat of *Podozamites Hackeli*, Feistm., from the Jabálpur Group in India (Pal. Indica, 1878, Jabálpur Flora).

Locality and Horizon.—Bellarine beds, Victoria.

PODOZAMITES LONGIFOLIUS, *M'Coy.*

Podozamites longifolius, M'Coy, *loc. cit.*, 1874, p. 35, Pl. VIII, f. 3.
" " Feistmantel, *loc. cit.*, 1878, p. 112.
" " Tenison Woods, *loc. cit.*, 1883, p. 145.

Sp. Char.—Fronde angusta, rhachide tenui, pinnulis subcontractis, oblique insertis, confertis, ad basim incurvis, dehinc rectis, linearibus, obtuse acuminatis, longitudinaliter striatis, una stria media distincta.

Obs.—This is the smallest of the observed forms, and is also a rare plant. By the more strongly marked midrib it reminds us more of a *Cycadites*, though the other characters do not support this view.

Locality and Horizon.—Bellarine Beds, Victoria.

PODOZAMITES LANCEOLATUS, *Lindley and Hutton.*

Zamia lanceolata, Lindley and Hutton, Foss. Flora Gt. Brit., 1837, Vol. III, p. 194.
Podozamites distans, Schimper, Traité Pal. Vég., 1874, Vol. 2, p. 159, Pl. 71, f. 1.
Podozamites lanceolatus, Geyler, Jura Pflanzen aus Japan, 1877.
" " Feistmantel, Jabálpur Flora, Pal. Ind. Gondw. Flora, Vol. 2, p. 11 (91 et figs.)
" " Tenison Woods, *loc. cit.*, 1883, pp. 145, 146.

Sp. Char.—"Leaves remote, deciduous, entire, narrowed at base, lanceolate, acuminate at the apex; nerves many, forked just above the base, then simple and converging to the apex."

Obs.—This is a very characteristic form, widely spread in the Jurassic formation. It is known from Spitzbergen, England, South Russia, East Siberia, the Amúr Country, and Japan. In India it is pretty frequent in the Jabálpur Group.

This species was identified as Australian by Mr. Tenison Woods, who writes about it as follows:—"Both these varieties" (*P. lanceolatus*, var. *genuinus*, and *P. lanceolatus*, var. *spathulatus*, Feistm.) "occur abundantly in the Ipswich Basin; one specimen showing how the leaves were affixed to the parent stem, and, though the fragment is imperfect, it shows precisely the growth figured by Schimper (Atlas, Pl. 71, Fig. 1)."

PODOZAMITES DISTANS, *Presl.*

Zamites distans, Schenk, Fossile Flora der Grenzschichten des Keupers und Lias Frankens, 1868, Pl. 35, 36, 37.

Podozamites distans?, Tenison Woods, on the Wianamatta Shales (Journ. R. Soc., N. S. Wales, 1883, Vol. XVII, p. 75).

Obs.—In his above paper on the Wianamatta Shales, Mr. Tenison Woods has quoted this species from the Wianamatta beds, and doubtfully from the Hawkesbury rocks; it was quoted as one of those species, upon the occurrence of which in both of the mentioned rock groups Mr. Tenison Woods based his opinion that the Wianamatta Shales and Hawkesbury rocks form one connected series. In his later work on the Australian Flora (1883) this species is, however, not mentioned,* so that I can offer no further details, although I thought it necessary to make mention of it.

Locality and Horizon.—In Europe *Podozomites distans* occurs in Rhætic beds (passage beds between Trias and Jura). The occurrence in Australia would be pretty nearly on a similar horizon.

Genus—OTOZAMITES, *Fr. Braun.*

Obs.—This genus is rarely represented amongst the Australian fossils, only one species being hitherto known.

OTOZAMITES *comp.* MANDESLOHI, *Kurr*, sp.

Pl. XXVIII, Figs. 9, 9*a*.

Zamites Mandeslohi, Kurr, Beiträge z. Fl. der Juraform. Würtembergs, 1846, p. 10, Tab. I, f. 3.

Otozamites Mandeslohi, Schimper, Traité de Pal. Vég., 1870–72, II, p. 171.

Otozamites (comp. *Mandeslohi*, Kurr), Feistmantel, Foss. Flora Austr. Suppl., 1879, p. 171, Pl. XII, figs. 6, 6*a*.

Otozamites Mandeslohi, Tenison Woods, *loc. cit.*, 1883, p. 151.

Sp. Char.—"Foliis longis, linealibus, apicem versus sensim angustatis, foliolis dense confertis, obliquis, alternantibus, rhachi impositis, basique contiguis, ovato-oblongis, obtusis, basi subcordatis; nervis crebris divergentibus" *(Schimper.)*

Obs.—The above figured specimen belongs to the Cycadeaceæ and apparently to the genus *Otozamites*. The basal angles of the leaf are not, it is true, so distinctly auriculate as is usually the case, but still in the upper angle (with regard to the position of the figure) the auriculation is somewhat indicated, and also the distribution of the veins agrees with that of an *Otozamites.* The leaflets are closely set, touching at the base, alternate, oblongly ovate, with the apex rounded; the veins are numerous, radiating into the leaf, and forked.

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* [The name *Podozamites distans* is distinctly given by the Rev. J. E. Tenison Woods on p. 109 of his 1883 work (separate copies), and p. 145 of *Proc. Linn. Soc. N. S. Wales*, 1883, viii, in the synonymy of *Podozamites lanceolatus*, L. and H.—R. E., jun.]

Amongst the species of *Otozamites* already described the closest ally to the Australian form is Kurr's *Otozamites Mandeslohi,* the diagnosis of which is given above. I could find no difference between the two, except, perhaps, that in our specimen the leaflets are somewhat more symmetrical.

Otozamites Mandeslohi, Kurr, sp., was, it is true, described from the Lias of Ohmden in Würtemberg, but this could of course form no objection to a comparison of both specimens.

Locality and Horizon.—In the Upper Mesozoic coal beds at Talgai (Talgai Diggings), on the Condamine River, Queensland.

Genus—PTILOPHYLLUM, *Morris.*

Ptilophyllum, Morris, in Grant's "Geology of Cutch" (Trans. Geol. Soc., 1840, Vol. V, 2nd Ser., Pl. XXI.)
„ Morris, Ann. and Mag. Nat. Hist., 1841, Vol. VII, pp. 116, 117.
Palæozamia, Oldham and Morris, Rájmahál Flora, 1862, p. 26.
Ptilophyllum, Schimper, Traité Pal. Vég., 1871, II, p. 165.
„ Feistmantel, Palaeont. Beiträge, Cassel, 1876, p. 5, figs.

Sp. Char.—"Foliis petiolatis, petiolo rhachique teretibus foliis elongatis, pennæformibus, apicem basimque versus angustatis. Foliolis (pinnis) inter se æqualibus, subalternis, lateri anteriori (i.e., superiori) adfixis, coriaceis, linearibus, apice plus-minusve oblique sursum acuminatis, leniterque arcuatis; basis angulo superiore rotundato subauriculato, libero; inferiore adfixo, retro folii infra positi basin decurrente.; nervis frequentibus, basi partim divergentibus, simplicibus, apice nonnullis furcatis; fructificatione adhuc ignota.

Obs.—The above is the general diagnosis of the leaf. According to my investigations the chief character lies in the leaflets, which have the superior (or anterior) basal angle rounded, sub-auriculate and free, while the lower (or posterior) angle is fixed and decurrent behind the rounded and free angle of the next lower leaflet.

This genus, with two or three species and several varieties, is very numerously represented in India, in the upper portion of the Gondwána System (generally speaking Jurassic). From Australia Mr. Tenison Woods described one species.

PTILOPHYLLUM OLIGONEURUM, *Ten. Woods.*

Ptilophyllum oligoneurum, Tenison Woods, *loc. cit.*, 1883, p. 149, Pl. 7, figs. 2, 3, 4.

Sp. Char.—Frond pinnate, long linear, gradually tapering to the apex; pinnæ rather long, narrow, slightly oblique, alternate, separate, but very close, rounded and curved, somewhat falcate, ending in quite an acute apex at the upper edge; base rounded or articulate above, obliquely inserted, leaving when detached a series of oblique alternate elongate depressions on the rachis; veins distinct from their origin and parallel to the apex, from four to six in number, all well marked and conspicuous; length of longest pinnæ 12 to 15, breadth 1½ to 2 mm.

Locality and Horizon.—Very common in the plant formation of Rosewood, near Rockhampton, where it is associated with a *Sequoia* (?), a large *Equisetum*, some ferns and *Vertebraria.*

Genus—ZEUGOPHYLLITES, *Brongniart.*

Zeugophyllites, Brongniart, Prodr. Hist. Vég. Foss, 1828, p. 121.
" Feistmantel, *loc. cit.*, 1878, p. 95.
" Tenison Woods, *loc. cit.*, 1883, p. 15.

Gen. Char.—Frondibus (?) petiolatis, pinnatis; pinnis oppositis, oblongis; nervis validis, paucis, æqualibus, basi et apice confluentibus.

Obs.—This is the diagnosis which Brongniart gave from specimens from Raniganj, Bengal, in India. The species was *Zeugophyllites calamoides*, Bgt.

It was often insisted on that the *Zeugophyllites* of India was identical with *Schizoneura* from the Indian Gondwána system, and at first I was inclined to believe so. But when I saw that also, in his "Tableaux des Genres des Végétaux Fossiles" (p. 80)—which appeared five years later than the "Monographie des Plantes Fossiles du Grés Bigarré," &c., 1847, and in which there are good figures of *Schizoneura paradoxa*—Brongniart makes no allusion to any relation of his genus *Zeugophyllites* to *Schizoneura*, but describes it again as quite a distinct genus, I arrived at the conclusion that it must belong to some other family, and it appeared to me that it may be closely allied to *Podozamites*, Fr. Braun. I must, however, mention that I have not seen any specimen of this species, and it appears altogether not to be very numerous in Australia.

ZEUGOPHYLLITES ELONGATUS, *Morris.*

Pl. XXI, Figs. 6, 6*a*.

Zeugophyllites elongatus, Morris, *loc. cit.*, 1845, p. 250, Pl. VI, figs. 5, 5*a*.
Noggerathia elongata, Dana, *loc. cit.*, 1849, p. 715.
Zeugophyllites elongatus, Feistmantel, *loc. cit.*, 1878, p. 95, Pl. XIII, figs. 6, 6*a*.
" " Tenison Woods, *loc. cit.*, 1883, p. 152.

Sp. Char.—Trunco? Foliis (pinnis) oblonge elongatis, integris, truncatis, ad basim subcrassiusculis, in petiolum attenuatis, nervis distinctis æqualibus, subparallelis, supra basim, nonnulis furcatis (?).

Obs.—I have reproduced Prof. Morris's original figure, which distinctly shows that the specimen is no *Schizoneura;* on the contrary, it reminds us strongly of a Cycadeaceous leaf. The enlarged Fig. 6*a* clearly shows that all the veins belong to the substance of the leaf, which thus appears to be single, and not composed, as in *Schizoneura*, of several leaflets joined together along their marginal lines, and forming thus the sheath portions of the genus *Schizoneura*. From Morris's figure it also appears that the veins were forked closely above the base, which in *Schizoneura* is never the case.

Locality and Horizon.—In the Upper Coal beds (Mesozoic) of the Jerusalem Basin, Tasmania. (M'Coy quotes it also from Mulubimba, New South Wales, but Mr. Tenison Woods doubts this quotation being correct.)

AFFINITIES UNCERTAIN.

Genus—CORDAITES, *Unger.*

Obs.—This genus formed once, together with *Nöggerathia*, Stbg., a special family of the Cordaiteæ, which was at various times differently placed Lately, however, a great number of the various species of *Nöggerathia* were eliminated, and placed with other divisions; while in the Cordaiteæ there remained *Cordaites*, and some other remains of inflorescences and seeds. This family is now placed in the order of Gymnospermous plants, between Cycadeaceæ and Coniferæ.

From Australia one species of *Cordaites* has been described.

CORDAITES AUSTRALIS, *M'Coy.*

Cordaites australis, M'Coy, Pal. Vict., 1876, Dec. IV, p. 22, Pl. XXXVI, figs. 6, 7.
" " Tenison Woods, *loc. cit.*, 1883, p. 155.

Sp. Char.—" Leaves several inches long, thick, flattened, parallel-sided, with unequal longitudinal parallel striæ ; clasping base slightly widened, and bent a little downwards; leaves at 1 inch from the base, about 4 to 5 lines wide, base about 2 or 3 lines wider."

Obs.—" The leaves of this species, although narrow, are much thicker in the substance than in any other known species, and the parallel veins are more unequal and less distinct, the larger having fewer and subequal small ridges, with much more numerous subequal fine striæ, thus approaching more to the foliage of *Dammara,* and favouring Mr. Grand-Eury and Prof. Schimper's idea of coniferous affinities."

Locality and Horizon.—Common to the Upper Devonian flags of Iguana Creek, Victoria.

Family—NÖGGERATHIOPSIDEÆ, Feistmantel.

Genus—NÖGGERATHIOPSIS, *Feistmantel.*

Nöggerathiopsis, Feistmantel, Talchir-Karharbári Flora (Gondwána Flora, 1879, Vol. III, p. 23.)
" Feistmantel, Supplement to the above, 1881, p. 55.
" Feistmantel, Foss. Fl. von Australiens, Suppl., 1879, p. 155.
" Tenison Woods, *loc. cit.*, 1883, p. 152.
" Feistmantel, Gondwána Flora, 1886, Vol. IV, Pt. 2, p. 38, *et seq.*
(Compare *Rhiptozamites,* Schmalhausen, Beiträge Jur. Flora Russlands, 1879.)

Obs.—In Australia, as well as in India, there occur pretty frequently, at various horizons, certain leaves, which were formerly classed with the genus *Nöggerathia,* Stbg.

In my above Talchir-Karharbári Flora I tried (*loc. cit.*, p. 20) to show that these leaves, called *Nöggerathia,* from the Indian Coal beds, were distinct from the European *Nöggerathia* leaves, in the sense of Profs. Weiss, Schimper, and Heer. I therefore placed these Indian leaves in a separate family, Nöggerathiopsidæ, with the genus *Nöggerathiopsis,* Feistm. With regard to the same leaves from Australia, there is no doubt that they belong to the same family and genus.

I think *Zeugophyllites elongatus*, Morris, does not fit well in the genus *Nöggerathia*, nor in the present *Nöggerathiopsis;* and Mr. Etheridge, in his Catalogue, has also separated it from *Nöggerathia* (the present *Nöggerathiopsis*). The systematic position, like that of *Cordaites*, is not yet quite satisfactorily decided, and many heterogeneous leaves were included in that genus. The last view, therefore, was that the genus *Nöggerathia* belonged to the Gymnosperms, between the Conifers and Cyadeaceæ. But in 1879 my father showed that certain species of *Nöggerathia* from the Bohemian coal beds exhibited a fructification, as is usual in ferns (with sporangia and spores); so that they had to be placed with the ferns. Other types were also separated and placed in various other orders.

The Indian and Australian leaves remain, however, unaffected by this discovery, as they appear best characterized as belonging to the Cycadeaceæ. Similar leaves to those in India and Australia were also collected by Tchihatcheff in the Altai Mountains, and Prof. Göppert described them as *Nöggerathia distans* and *N. æqualis*, and the formation was then said to be Permian.[*] But later investigations by Prof. T. Schmalhausen have shown that these plant deposits on the Altai belong to the Jurassic Formation. The said species of *Nöggerathia* he considered then as leaflets of Cycadeaceous plants, which showed affinities with *Zamia* and *Podozamites*, and he proposed for these species of *Nöggerathia* a new generic name, *Rhiptozamites.*

In the Supplement to my Australian Flora (1879) I have already pointed to the close relation of *Nöggerathiopsis* and *Rhiptozamites;* and in the Supplement to my Talchir-Karharbári Flora (1881) I have established the family Nöggerathiopsideæ, to include both these genera, classing them with Cycadeaceæ.

In a more recent publication Prof. Schmalhausen[†] declared his *Rhiptozamites* and my *Nöggerathiopsis* to be identical, of which I was also aware before. But while Prof. Schmalhausen, in 1879, was quite convinced of the Cycadeaceous nature of his leaves, calling them at once *Rhiptozamites*, he is now more inclined to consider this genus as belonging rather to the Cordaiteæ (between Cycadeaceæ and Coniferæ); so that my genus *Nöggerathiopsis* would have to be classed in the same way. But, from the reasons given by Prof. Schmalhausen, it is not quite evident whether he is quite correct in classing these leaves with the Cordaiteæ, and I think the present material is not sufficient for such a decision. I would therefore consider *Nöggerathiopsis* and *Rhiptozamites* to form a separate section of plants, which eventually may represent, in Asia and Australia, the Cordaiteæ of Europe and America; but as long as the real attachment of the leaves and leaflets, the inflorescence, and fructification are unknown, it is as correct to place the Nöggerathiopsideæ with the Cycadeaceæ as with the Cordaiteæ. But one question would remain—which of the two names, *Rhiptozamites* or *Nöggerathiopsis,* should be retained in case such a transfer from the Cycadeaceæ to the Cordaiteæ should be effected? Not regarding the question of priority—which it is rather difficult to decide, as both names appear to have been given simultaneously, but independently—it appears to me that *Nöggerathiopsis* is the *better* name. Both the Indian and Siberian leaves were formerly called *Nöggerathia.* Recognising that they do not belong to *Nöggerathia,* I called the Indian and Australian leaves *Nöggerathiopsis,* which thus reminds one of the previous name, without having special reference to any family. Prof. Schmalhausen, however, being at first *convinced* of the Cycadaceous nature of his leaves, called them *Rhiptozamites,* a name which has no reference to the previous denomination, but which is a closely defined name, indicating not only the class Cycadeaceæ, but also the family Zamieæ, in which the genus was intended to be placed. If now, as Mr. Schmalhausen thinks, these leaves would rather belong to the Cordaiteæ, then it would follow that *Rhiptozamites* would rather be a misplaced name in that family, which probably is more allied to the Coniferæ. Thus I think it is much more natural to retain the name *Nöggerathiopsis,* in the family Nöggerathiopsideæ, including *Rhiptozamites,* and being perhaps more closely allied with Cycadeaceæ.

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[*] Tchihatcheff, Voyage dans l'Altai orientale, &c., 1845, p. 378.

[†] Pflanzenpalaeontologische Beiträge: Mélanges Biol., Tome XI, 1883.

From Australia there are several species of *Nöggerathiopsis,* Feistm., known, and this in the Lower Coal Measures (Carboniferous) and Upper Coal Measures (Permian?). In India the same genus appears at first in the Talchir Shales (Permian), and passes up into the highest Damuda beds, Raniganj-Kámthi Group (Trias).

NÖGGERATHIOPSIS HISLOPI, *Feistmantel.*

Noggerathia? (Cyclopteris?) Hislopi, Bunbury, Quart. Journ. Geol. Soc., 1861, Vol. XVII, p. 334, Pl. X, f. 5.

Nöggerathiopsis Hislopi, Feistmantel, Flora of the Talchir-Karharbári Beds, 1879, p. 23 *et seq.*, figures.

Obs.—This is a pre-eminently Indian species. It was at first described by Sir Charles Bunbury, from the Kámthi beds, and thereafter it was recognised from all the beds of the Lower and Middle Gondwána portion.

In Zittel's "Handbuch der Palæontologie" there is the following system of the Coniferæ, given by Professor Schenk, with regard to the fossil remains:—

1. Taxaceæ with the genera—
   - *Gingkophyllum,* Saporta. Carboniferous and Permian, in Europe.
   - *Baiera,* Fr. Braun (including *Jeanpaulia*). Permian to Cretaceous, in Europe and America.
   - *Gingko,* Linn. Living in China and Japan; fossil from Permian through all formations; also in India.
   - *Rhipidopsis,* Schmalh. Jurassic of Russia (Siberia); in India in the Damuda division.
   - *Dicranophyllum,* Grand 'Eury. Carboniferous and Permian, in Europe, America, and China.
   - *Trichopitys,* Saporta. Permian and Jurassic, in Europe.
   - *Czekanowskia,* Heer. Rhætic, Jurassic, and Cretaceous, in Europe, Siberia, and China; also in India.
   - *Feildenia,* Heer. Tertiary, in the Arctic region.
   - *Phœnicopsis,* Heer. Jurassic of Europe and North-East Siberia; also in India.
   - *Euryphyllum,* Feistm. Karharbári beds (Lower Gondwána portion), in India.
   - *Taxites,* Brgt. Upper Gondwánas, India.

2. Walchieæ—
   - *Walchia,* Stbg. Carboniferous and Permian.
   - *Ullmannia,* Göpp. Permian.
   - *Pagiophyllum,* Heer (*Pachyphyllum,* Sap.) Jurassic to Tertiary, Upper Gondwánas, in India.

3. Araucarieæ—
   - *Dammara,* Lambert. Living, but several species described from Cretaceous rocks.
   - *Araucaria,* Juss. (*Araucarites,* Stbg.). Living; amongst fossils it begins in Jurassic times (Upper Gondwánas, in India).
   - *Cunninghamites,* Stbg. Living (*Cunninghamia*); fossil in Cretaceous and Tertiary formations.
   - *Albertia,* Schimp. and Moug. Lower Trias (Bunter), in Europe; in India, from the Karharbári beds.

4. Taxodiaceæ—

Voltzia, Bgt. Begins in Permian and goes up into Middle Keuper (Upper Trias); in India, in the Lower and Middle Gondwánas.
Leptostrobus, Heer. Jurassic.
Cyclopitys, Schmalh. Jurassic, in Russia (Siberia); also in India.
Taxodium, Rich. Living and Tertiary.
Glyptostrobus, End. Cretaceous and Tertiary.
Sequoia, Torrey. Living, Cretaceous and Tertiary.
Brachyphyllum, Brgt. Rhætic, Jurassic, and Wealden.
Echinostrobus, Schimp. Jurassic, in Europe; Upper Gongwánas, in India.
Sphenolepidium, Heer. Rhætic up to Wealden.
Inolepis, Heer. Cretaceous of Greenland.
Schizolepis, Braun. Permian to Jurassic.
Cheirolepis, Schimp. Rhætic and Liassic.
Swedenborgia, Nath. Rhætic.

5. Cupressineæ—

None of the Australian fossil Coniferæ belong to this family.

6. Abietineæ—

Of this family also there is no representative amongst the Australian fossil plants.

TAXACEÆ.

Genus—BAIERA, *Fr. Braun.*

(Schenk, in Zittel's Handbuch der Palæontologie, 1884, p. 261. (Synonym, *Jeanpaulia*).)

Obs.—The leaves of this genus were formerly placed with the Algæ Ferns, and Marsiliaceæ. But Prof. Heer has determined their proper place with the Coniferæ. The genus, which is now extinct, approaches the fossil genus *Gingkophyllum*, Sap.; on one side, and the still living genus *Gingko* on the other.

It begins in the Permian and goes up into the Cretaceous formation. From Australia there are three species known, two of which were described as *Jeanpaulia*, and one as *Baiera*.

BAIERA BIDENS, *Ten. Woods.*

Jeanpaulia bidens, Tenison Woods, *loc. cit.*, 1883, p. 132, Tab. IV, Fig. 8.

Sp. Char.—" Frond broadly flabellate, segments somewhat short, often becoming broader towards the apex and ending in a short, wide bifurcation, or in a curved falcate, acute, or acuminate point; veins not conspicuous, numerous (6 to 10), parallel, not branching. The longest of the segments in the specimen figured is 55 mm., and the width is from 3 to 6 mm."

Obs.—Mr. Tenison Woods placed it amongst the ferns and compared it with *Helminthostachys* and *Schizæa.*

Locality and Horizon.—In the Burnett River coal seams, Queensland (Mesozoic).

BAIERA PALMATA, *Ratte.*

Jeanpaulia palmata, Ratte, Proc. Linn. Soc., N. S. Wales, 1887, 2d Ser., Vol. I, Pt. 4, pp. 1078–1084, Pl. XVII.

Salisburia palmata, Ratte, *Ibidem*, 1887, Vol. II, Pt. 1, p. 137.

Obs.—This fine species consists of a leaf of considerable size, with a quite distinct stalk, and with the leaf portion expanded in the form of a palm leaf.

Mr. Ratte at first described it as *Jeanpaulia (?) palmata.* I have already, in the first part of this Memoir under Lit. No. 70 (New South Wales), pointed out that *Jeanpaulia* is to the greatest part synonymous with *Baiera*, and that in this case also the specific name would have to be changed, as there has been already a *Baiera palmata* described by Prof. Heer from the Jurassic formation of Siberia, and I then proposed to call it *Baiera flabelliformis.*

From a quite recently advertised paper by Mr. Ratte, I see that he places the fossil now with *Salisburia ;* but this name also would not be quite fortunately chosen, as these leaves are now comprised under the generic name *Gingko*, Linn. I have with this indicated the whole state of the matter, and must for other information refer to Mr. Ratte's above papers, pointing distinctly to the fact that a *Baiera palmata*, Heer, has previously been described.

Locality and Horizon.—This fossil occured in the Wianamatta Shales, New South Wales (Mesozoic).

BAIERA TENUIFOLIA, *Johnston.*

B. tenuifolia (Johnston), Ratte, *loc. cit.*, 1887, Vol. I, Pt. 4, 2d. Ser., p. 1080, Pl. XVI, f. 8.

Obs.—This species is mentioned by Mr. Ratte in his above paper.* He writes:—"It has not a palmate frond like *Baiera digitata* (Bgt.), Schenk, and has more the outline of *Jeanpaulia Münsteriana* (Presl.), Unger, on a smaller scale, while the leaves are narrower comparatively than in this last plant."

From the drawing it appears to me that it would rather represent a species of *Trichopitys*, Saporta (Schenk, in Zittel's "Handbuch der Palæontologie," 1884, II Bd., 3 Lief., p. 267).

Locality and Horizon.—In the coal seams at Newtown, Jerusalem Basin, Tasmania (Mesozoic).

Genus—TAXITES, *Brongniart.*

TAXITES MEDIUS, *Ten. Woods.*

Taxites medius, Tenison Woods, *loc. cit.*, 1883, p. 160, Pl. IX, f. 3.

Sp. Char.—"Branchlets thin; leaflets spirally and bilaterally disposed, emerging at an acute angle, subalternate, sometimes slightly curved outwards, narrow linear, obtuse, rather long and the decurrent pedicel thick, long and broad (nearly as broad as the leaf at times); midrib thick and conspicuous, surface shining and transversely wrinkled."

Obs.—Mr. Tenison Woods named this species, from its intermediate character between the two Indian forms, *T. tenerrimus*, Feistm., which has very small horizontal leaflets, and *T. planus*, Feistm., which has also horizontal leaflets, but much longer and broader.

Locality and Horizon.—In the coal beds at Ipswich, Queensland (Upper Mesozoic).

2. *WALCHIEÆ.*

Genus—WALCHIA, *Sternberg.*

Obs.—The species of this genus are mostly represented in the Permian formation, although the latter reminds us in some respects of some Jurassic forms, such as *Brachyphyllum*, *Pagiophyllum*, &c.

Tenison Woods described one species.

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* [It has now been figured by Mr. Johnston (see Geology of Tasmania, 1888, t. 26, figs. 19 and 19*a*).—R.E., jun.]

WALCHIA MILNEANA, *Ten. Woods.*

Walchia Milneana, Tenison Woods, *loc. cit.*, 1883, p. 163, Pl. II, f. 3.

Sp. Char.—"Branches obtuse; leaves very closely imbricate, spirally disposed, so as to leave three to four visible in each spiral; falcate, acuminate, breadth at base half the length, mucronate in young branches, obtuse in older ones, curving together in linear scale-like leaves at the top."

Locality and Horizon.—At Ballimore Hill, Talbragar River Coal-field, near Dubbo, New South Wales, where it appears to be abundant (Ten. Woods). Hawkesbury rocks (Mesozoic).

3. *ARAUCARIEÆ.*

Genus—ARAUCARITES, *Schimper.*

(*Araucaria*, Jussieu.)

Obs.—This genus, according to Prof. Schenk, in Zittel's "Handbuch der Palæontologie" (II Bd., 3 Lief., p. 280), occurs chiefly in the Mesozoic, but also in the Tertiary formations.

Mr. Tenison Woods described (*loc. cit.*, 1883, p. 165, Pl. X, Fig. 1) a fruit cone, which he introduced into literature under the name of *Araucarites (?) polycarpa.*

Locality and Horizon.—In the coal beds of the Burnett River, Queensland, in an ironstone concretion (Mesozoic).

Genus—CUNNINGHAMITES, *Sternberg.*

Obs.—The various species which were hitherto known came from Cretaceous rocks. Tenison Woods describes one species from somewhat older rocks, while some doubtful fragments, perhaps of the same genus, were made known from the Rájmahál Group in India.

CUNNINGHAMITES AUSTRALIS, *Ten. Woods.*

Cunninghamites australis, Tenison Woods, *loc. cit.*, 1883, p. 165, Pl. III, Figs. 1-3; Pl. IV, f. 1.

Sp. Char.—"Leaves long, linear, pointed, decurrent, entire; male amenta in rather thick, corrugated clusters at the ends of the branches;

generally two of the amenta are alone distinct in the fossil, but others can always be traced in the centre; they are curved."

Locality and Horizon.—Abundant in a pale yellowish shale at Rosewood, Queensland (Mesozoic).

4.—*TAXODIACEÆ.*

Genus—SEQUOIITES, *Carruthers.*

(*Sequoia*, Torrey.)

Obs.—The earliest representatives of this genus were previously known from Wealden beds; it further occurs in Cretaceous and Tertiary rocks, and is found amongst the living plants (*Sequoia sempervirens*, west side of North America and in the south of California, and *S. gigantea* in California).

Tenison Woods described one species from Queensland.

SEQUOIITES (?) AUSTRALIS, *Ten. Woods.*

Sequoiites (?) australis, Tenison Woods, *loc. cit.*, 1883, p. 162, Pl. VII, f. 5.

Sp. Char.—"Leaves very close, two-rowed (?), spread out, flat, alternate, straight, rarely falcate, smooth above, midrib prominent below, rounded at the apex, towards which there is only a very slight tapering, not contracted at the base, but becoming a sheath, down the centre of which the midrib can be distinctly traced, from 20 to 25 mm. long, and 1½ wide, but much shorter and smaller near the extremities of the shoots, where they are somewhat imbricated all round the branch and loosely spiral. The sheathing base of the leaves gives rise to a jointed appearance of the stem. Length of the longest fragment 91 mm., on which there were about fifty leaves; width about 25 mm., at base tapering to 8 mm."

Locality and Horizon.—In the plant beds of Rosewood, near Rockhampton, Queensland, associated with *Ptilophyllum oligoneurum* (Mesozoic, Jurassic).

Genus—BRACHYPHYLLUM, *Brongniart*, 1828.

(Prodrome d'une Hist. Vég. Foss., p. 109.)

Obs.—This genus is represented by various species in Rhætic strata, passing up into Cretaceous beds. I have also identified this genus from the Upper Gondwána System in India.

The type species is *Brachyphyllum mamillare*, Brgt. (L. & H.), from the Lower Oolite in England, and I described the same from the Jabálpur Group of India. Two other species, *B. affine* and *B. Münsteri*, which were described by Prof. Schenk, were placed by Prof. Schimper in a new genus—*Cheirolepis*, which I have also recognised amongst the Indian fossil plants.

From Australia one species and one variety is known.

BRACHYPHYLLUM (?) AUSTRALE, *Feistmantel.*

Pl. XV, Fig, 4; Pl. XXII, Figs. 1, 2.

B. (?) *australe*, Feistmantel, Foss. Fl. Austr., 1878, p. 97, 98, Pl. VII, Figs. 3–6; Pl. XVII.
" Tenison Woods, *loc. cit.*, 1883, p. 159.

Sp. Char.—Ramulis elongatis, teneris, flexuosis, ramificatis; foliis spiraliter dispositis, squamæformibus, rhombee-oblongis, crassiusculis, apice acuminatis, subcarinulatis, subpatulis. Amentis rotundis, squamis sub-rhombee-acute acuminatis, apice paulum patulis, subcarinulatis spiraliter dispositis tectis.

" Branchlets elongate, slender, flexuous, much branched, leaves spirally disposed, squamiform, rhomboid-oblong, somewhat thick, apex acuminate, sub-keeled and a little flattened; amentum covered with sub-rhomboid, acute, acuminate scales, the apex somewhat flattened and spirally disposed."

Obs.—The form and position of the leaves reminds us much of the typical species of *Brachyphyllum*, although I am not acquainted with the fruit cone of *B. mammillare*; and the ramification also is not so frequent in the Australian species.

In its general habit our plant resembles *Echinostrobus Sternbergi*, Schimp., from Solenhofen (Schimper, Traité Pal. Vég., Pl. lxxv, Figs. 21–24), especially as regards the mode of ramification, but the fruit cones are quite different. Also *Palissya aptera*, Schenk (Schimper, *loc. cit.*, Pl. lxxv, Fig. 6), approaches somewhat our plant, but the mode of ramification is not distinctly exhibited in Schimper's figure, and the fruit cones (Schimper, *loc. cit.*, Fig. 5) appear larger and looser.

In Mr. Saporta's "Jurassic Plants of France" (Pal. Franç., Vég. Terrain jurassique, Livr. 24, 1877) there is, on Pl. clxi, a figure of *Brachyphyllum Papareli*, Sap., which also reminds us very much of our plant, so that I think that its place is rather with *Brachyphyllum* than with *Echinostrobus*, as has been stated by Prof. Schenk in Zittel's "Handbuch der Palæontologie," (II Bd., 3 Lief., 1884, p. 331).

Occurrence.—In the Newcastle beds (Upper Coal Measures) at Bowenfels, Eskbank and Lithgow Collieries,* New South Wales (Palæozoic, ? Permian).

BRACHYPHYLLUM AUSTRALE, *var.* CRASSUM, *Ten.-Woods.*

Brachyphyllum australe var. *crassum*, Tenison Woods, *loc. cit.*, 1883, p. 159, Pl. V.

Obs.—Mr. Tenison Woods refers at first to *Mamillaria Desnoyersii*, and writes:—"Branches and branchlets rigid, coarse and thick; leaves more or less irregular in shape and mammilately shield-like, bases contiguous five to six angled." Schimper separates this fossil from *B. mamillare*, L. and H., which is much more slender and with more numerous branches. It is found abundantly in the Oolite of Oxfordshire, Wiltshire, Yorkshire, and in several places in France. The above is Schimper's definition.

"In the Geological Magazine for 1869 (Vol. VI) there are figures on Plate II, Figs. 12, 13, of branches of a coniferous plant, which Schimper identifies with this species. That which I distinguish as a variety of the same may be thus described:—Plant robust, thick; stem and branches repeatedly dichotomous. Leaves thick and fleshy, densely crowded, homodromous, short, broad, obtuse, conspicuously keeled, erect, closely imbricate, but slightly spreading. Branches and branchlets very little narrower than the parent stem and of equal width to the summit. All portions of the plant curved. Three leaves visible in each spiral. About three rows in a centimetre. Length of leaves from 2 to 3 mm.; breadth from 5 to 6. Diameter of cauline stem at widest part 10 mm.; of branchlets 8 mm.; length of shortest, 18 mm."

"Amongst the fragments imbedded around, there are some with rhomboidal depressions like lepidodendroid scars. These are stems from which the leaves have been shed. They are about 30 mm. long and 2 wide."

Locality and Horizon.—In the coal beds at Ipswich, Queensland (Upper Mesozoic).

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* [See second foot note, p. 38—R.E., jun.]

INCERTÆ SEDIS.

Here are included a few seed and scale-like fossils, the positions of which are, however, not certainly known.

CARDIOCARPUM (?) AUSTRALE, *Carruthers.*

Cardiocarpum australe, Carruthers in Daintree, *loc. cit.*, 1872, p. 356, Pl. XXVII, f. 4.

Sp. Char.—Fructa cordata, apice acuminata; semine ovato acuto.

Obs.—Nothing is said about the possible relationship of this fossil.

Locality and Horizon.—Tivoli Mines, Queensland (Upper Jurassic).

SAMAROPSIS (?) sp.

Obs.—In the Indian plant beds, especially in the lower and middle division, there occur certain winged seeds, the relation of which to certain plants, and consequently their systematic position, is not quite clear. They resemble very much similar seeds described by Prof. Heer under the name *Samaropsis,* and which were figured by Prof. Heer in his Jurassic Flora of E. Siberia and the Amur Countries, and also by Prof. Schmalhausen from the Altai, Tunguska River and the Petschora country. From India I have figured them in several of my papers; quite recently in Pal. Indica, Vol. IV, Pt. 2, 1886 (Gondwâna Flora), p. 45, Pl. XIV, A., Figs. 7–15.

Quite similar seeds occur in the Australian Fossil Flora, where I have only recently identified them amongst the plants from the Mersey Coal beds, Tasmania (Permo-Carboniferous.)

SQUAMÆ GYMNOSPERMARUM ?

Obs.—Those peculiar scale-like fossils, which I have identified amongst the Indian plants, also occur in Australia; some of them were figured by Dana (*loc. cit.*, p. 714, Pl. XII, Figs. 1–8) from the Newcastle District, and I have identified them from the Mersey Coal beds, Tasmania (Permo-Carboniferous). They have also been figured by Prof. Schmalhausen, but their nature remains doubtful, and their occurrence is only interesting as illustrating further their wide distribution under similar circumstances.

They may, perhaps, be, like the above seeds, *Samaropsis,* in some connection with the genus *Nöggerathiopsis,* respectively with the genus *Rhiptozamites* in Siberia, which circumstance would explain their occurrence and distribution in the above strata and countries.

ALPHABETICAL LIST OF LOCALITIES, WITH THE FOSSILS FOUND AT THE SAME.

Anvil Creek, W.N.W. from Newcastle, New South Wales.—*Phyllotheca* and *Glossopteris* only generally mentioned. Lower Coal Measures. Middle and Upper Carboniferous.

Avon River, Gippsland, Victoria.—*Lepidodendron australe,* M'Coy. Carboniferous.

Arowa, New South Wales.—*Rhacopteris inæquilatera,* Gpt.; *Glossopteris linearis,* M'Coy. Lower Carboniferous.

Bacchus Marsh, W.N.W. of Melbourne, Victoria.—*Gangamopteris angustifolia,* M'Coy; *G. spathulata,* M'Coy; *G. obliqua,* M'Coy. Bacchus Marsh beds. Permian (?).

Back Creek Diggings, Barrington River, New South Wales.—*Lepidodendron nothum,* Ung. Upper Devonian.

Ballimore Hill, Talbragar River Coal-field, New South Wales.—*Sphenopteris crebra,* Ten. Woods; *Alethopteris Currani,* Ten. Woods; *A. concinna,* Ten. Woods; *Merianopteris major,* Feistm.; *Walchia Milneana,* Ten. Woods. Hawkesbury beds. Lower Mesozoic.

Barrabool Hills, Victoria.—*Alethopteris australis,* M'Coy; *Tæniopteris Daintreei,* M'Coy. Upper Mesozoic coal beds.

Bellarine, east of Geelong, Victoria.—*Alethopteris australis,* M'Coy; *Podozamites Barkleyi,* M'Coy; *P. ellipticus,* M'Coy; *P. longifolius,* M'Coy. Upper Mesozoic coal beds.

Bell River, near Wellington, New South Wales.—*Neuropteris australis,* Ten.-Woods. ? Hawkesbury beds. Lower Mesozoic.

Blackman Swamp, west of Sydney, New South Wales.—*Glossopteris Browniana,* Brgt.; *G. tæniopteroides,* Feistm.; *G. Wilkinsoni,* Feistm. Newcastle beds. ? Permian.

Bobuntungen, Queensland.—*Calamites radiatus*, Brgt.; *C. varians*, Germ.; *Lepidodendron Veltheimianum*, Stbg.; *Knorria* state of the same. Lower Carboniferous.

Bowenfels, W.N.W. of Sydney, New South Wales.—*Vertebraria australis*, M'Coy; *Glossopteris Browniana*, Bgt.; *G. communis*, Feistm.; *G. parallela*, Feistm.; *G. linearis*, M'Coy; *G. gangamopteroides*, Feistm.; *G. spathulato-cordata*, Feistm.; *Gangamopteris Clarkeana*, Feistm.; *Nöggerathiopsis media* (= *N. elongata*), Dana, sp.; *Brachyphyllum australe*, Feistm. Newcastle beds. ? Permian.

Broken River, tributary of the Clarke River, Queensland.—*Lepidodendron nothum*, Ung. Upper Devonian.

Burnett River, Queensland.—*Sphenopteris flabellifolia*, Ten. Woods, and var. *erecta*; *Baiera bidens*, Ten. Woods; *Araucarites (?) polycarpa*, Ten. Woods. Mesozoic beds.

Canoona River, district of Maryborough, Queensland.—*Lepidodendron nothum*, Ung. Upper Devonian.

Canowindra, Lachlan River, New South Wales.—*Lepidodendron nothum*, Ung. Upper Devonian.

Cape Paterson, Victoria.—*Phyllotheca australis*, M'Coy; *Tæniopteris Daintreei*, M'Coy. Upper Mesozoic coal beds.

Clarence River, at Southgate, New South Wales.—*Tæniopteris Daintreei*, M'Coy; *Alethopteris australis*, M'Coy. Mesozoic.

Clarke's Hill, near Cobbitty, west of Sydney.—*Phyllotheca australis* (as *P. Hookeri*), M'Coy; *Thinnfeldia odontopteroides*, Feistm.; *Odontopteris microphylla*, M'Coy; *Pecopteris (?) tenuifolia*, M'Coy. Wianamatta. Mesozoic.

Cockatoo Island,* New South Wales.—*Cleithrolepis granulatus*, Eg.; *Myriolepis Clarkei*, Eg.; *Labyrinthodont fossil*. Hawkesbury beds. Lower Mesozoic.

Coleraine, Wannon River, Victoria. *Tæniopteris Daintreei*, M'Coy. Upper Mesozoic.

Cowra, Lachlan River, New South Wales.—*Lepidodendron nothum*, Ung. Upper Devonian.

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* [Port Jackson.—R. E., jun.]

Dawson River, Queensland.—*Sphenopteris lobifolia*, Morr. Coal Measures (Permo-Carboniferous.)

Darling Downs, Queensland.—*Alethopteris australis*, M'Coy, sp.; *Sagenopteris rhoifolia*, Presl. Upper Mesozoic.

Dubbo, Talbragar River, New South Wales.—*Odontopteris macrophylla*, Ten. Woods; *Alethopteris australis*, M'Coy; *Hymenophyllites dubius*, Ten. Woods. Otherwise see also Ballimore Hill, and Talbragar River Coal-field. Hawkesbury Sandstone. Lower Mesozoic.

Goonoo Goonoo, Peel River District, Co. Parry, New South Wales.—*Lepidodendron nothum*, Ung.; *Cyclostigma*, sp. Upper Devonian.

Gosford, Brisbane Water, Broken Bay, New South Wales.—*Platyceps Wilkinsoni*, Steph. Hawkesbury Series. Lower Mesozoic.

Greta, W.N.W. of Newcastle, close to Anvil Creek, New South Wales.—*Annularia australis*, Feistm.; *Glossopteris primæva*, Feistm.; *G. Browniana*, Bgt.; *G. elegans*, Feistm.; *Nöggerathiopsis prisca*, Feistm. Lower Coal Measures (Permo-Carboniferous).

Guntawang, Mudgee, New South Wales.—*Gangamopteris angustifolia*, M'Coy. Newcastle beds. ? Permian.

Hawkesbury River, New South Wales.—*Sphenopteris alata*, Bgt. Horizon uncertain.

Iguana Creek, Mitchell River, North Gippsland, Victoria.—*Sphenopteris iguanensis*, M'Coy; *Archæopteris Howitti*, M'Coy; *Cordaites australis*, M'Coy. Upper Devonian.

Illawarra, south of Wollongong, New South Wales.—*Glossopteris Browniana*, Bgt.; *G. ampla*, Dana; *G. cordata*, Dana; *G. linearis*, M'Coy; *Nöggerathiopsis spathulata*, Dana, sp. (= *N. media*). Newcastle beds. ? Permian.

Ipswich, W.S.W. of Brisbane, Queensland.—*Equisetum rotiferum*, Ten. Woods; *Phyllotheca carnosa*, Ten. Woods; *Thinnfeldia odontopteroides*, Morris, sp.; *Alethopteris australis*, M'Coy; *Podozamites lanceolatus*, L. & H.; *Taxites medius*, Ten. Woods; *Brachyphyllum australe*, var. *crassum*, Ten. Woods. Upper Mesozoic coal beds.

Jerusalem Basin, Tasmania.—*Phyllotheca australis,* M'Coy; *Sphenopteris elongata,* Carr.; *Thinnfeldia odontopteroides,* Morris, sp.; *Alethopteris australis,* M'Coy; *Sagenopteris tasmanica,* Feistm.; *Lepidostrobus Muelleri,* Johnst. (Campania Sandstone); *Zeugophyllites elongatus,* Morr. Upper Mesozoic strata (Carbonaceous).

Longford, Tasmania.—*Pecopteris caudata,* Johnst.; *Tæniopteris Morrisiana,* Johnst. Upper Mesozoic.

Mersey Coal-field, Tasmania.—*Glossopteris Browniana,* Bgt.; *G. ampla,* Dana; *G. communis,* Feistm.; *G. spathulato-cordata,* Feistm.; *Gangamopteris angustifolia,* M'Coy; *G. cyclopteroides,* Feistm.; also varieties *attenuata* and *subauriculata; Tasmanites punctatus,* Newton; *Nöggerathiopsis Hislopi,* Feistm.; *Samaropsis* ? sp.; *Squamæ gymnospermarum* (?). Mersey Coal beds. Permo-Carboniferous.

Mount Lambie, New South Wales.—*Lepidodendron nothum,* Ung. Upper Devonian.

Mulubimba, New South Wales.—*Phyllotheca australis (P. ramosa),* M'Coy; *Vertebraria australis,* M'Coy; *Sphenopteris lobifolia,* Morr.; *S. alata,* Bgt.; *S. hastata,* M'Coy; *S. germana,* M'Coy; *S. plumosa,* M'Coy; *S. flexuosa,* M'Coy; *Glossopteris Browniana,* Bgt.; *Zeugophyllites elongatus,* Morr. Newcastle beds. ? Permian.

Newcastle, New South Wales.—*Urosthenes australis,* Dana; *Phyllotheca australis,* M'Coy; *Vertebraria australis,* M'Coy; *Sphenopteris lobifolia,* Morr.; *S. alata,* var. *exilis,* Morr.; *Glossopteris Browniana,* Bgt.; *G. linearis,* M'Coy; *G. ampla,* Dana; *G. reticulum,* Dana; *G. elongata,* Dana; *G. cordata,* Dana; *G. spathulato-cordata,* Feistm.; *Caulopteris Adamsi,* Feistm.; *Nöggerathiopsis media,* Dana, sp. (= *N. spathulata,* Dana); *Squamæ gymnospermarum.* Newcastle beds. ? Permian.

Newtown Coal Basin, Tasmania.—*Sphenopteris lobifolia* (?), Morr.; *Baiera tenuifolia,* Johnst. (= *Trichopitys*). Upper Mesozoic coal beds.

Parramatta, New South Wales.—*Palæoniscus antipodeus,* Eg.; *Cleithrolepis granulatus,* Eg. Wianamatta beds. Mesozoic.

Paterson, Cape, Victoria.—See Cape Paterson.

Port Stephens, N.E. of Newcastle.—*Sphenophyllum,* sp.; *Rhacopteris inæquilatera,* Göpp.; *R. intermedia,* Feistm. Lower Carboniferous.

Raymond Terrace, north of Newcastle, New South Wales.—*Phyllotheca*; *Glossopteris Browniana*, Bgt. Horizon uncertain.

Rix's Creek, New South Wales.—*Glossopteris Clarkei*, Feistm. Lower Coal Measures. Middle and Upper Carboniferous.

Rosewood, west of Rockhampton, Queensland.—*Vertebraria towarrensis*, Ten. Woods; *Sphenopteris Baileyana*, Ten. Woods; *Trichomanes laxum*, Ten. Woods; *T. spinifolium*, Ten. Woods; *Thinnfeldia odontopteroides*, Morris, sp.; and var. *falcata*, Ten. Woods; *Gleichenia lineata*, Ten. Woods; *Angiopteridium ensis*, Oldh., sp.; *Ptilophyllum oligoneurum*, Ten. Woods; *Cunninghamites australis*, Ten. Woods; *Sequoiites australis*, Ten. Woods. Upper Mesozoic.

Rouchel River, tributary of the Hunter River, Durham District, New South Wales.—*Lepidodendron Veltheimianum*, Stbg. Lower Carboniferous.

Smith's Creek, near Stroud, Gloucester District, New South Wales.—*Calamites radiatus*, Bgt.; *Rhacopteris inæquilatera*, Göppt., sp.; *R.* comp. *Römeri*, Feistm.; *R. septentrionalis*, Feistm.; *Archæopteris Wilkinsoni*, Feistm.; *Archæopteris*, sp.; *Cyclostigma australe*, Feistm.; *Lepidodendron dichotomum*, Stbg.; *L. Veltheimianum*, Stbg.; *Knorria* state of the same; *Lepidodendron Volkmannianum*, Stbg. Lower Carboniferous.

Spring Bay, Tasmania.—*Thinnfeldia odontopteroides*, var. *superba*, Ten. Woods; *T. trilobita*, Ten. Woods. Upper Mesozoic.

Spring Hill, north of Hobart, Tasmania.—*Trichomanides Ettingshauseni*, Johnst.; *Rhacopteris Feistmanteli*, Johnst.; *Thinnfeldia odontopteroides*, var. *obtusifolia*, Ten. Woods; *Thinnfeldia media*, Ten. Woods; *Tæniopteris tasmanica*, Johnst. (See also Jerusalem Basin.) Upper Mesozoic.

Southgate.—See Clarence River.

Stony Creek, between Newcastle and Greta, New South Wales.—*Glossopteris Browniana*, var. *præcursor*, Feistm. Lower Coal Measures. Middle and Upper Carboniferous.

Sugarloaf Hill, New South Wales.—*Phyllotheca concinna*, Ten. Woods. Hawkesbury beds. Lower Mesozoic.

Talgai Diggings, Talgai, in the valley of the Condamine River, South Queensland.—*Tæniopteris Daintreei,* M'Coy (the typical form); *Sagenopteris, rhoifolia,* Presl.; *Otozamites Mandeslohi,* Kurr, sp. Upper Mesozoic Coal beds.

Talbragar Coal-field, near Dubbo, New South Wales.—*Sphenopteris glossophylla,* Ten. Woods; *Thinnfeldia media,* Ten. Woods. Hawkesbury beds. Lower Mesozoic.

Tivoli Mines, Ipswich, Queensland.—*Vertebraria equiseti,* Ten. Woods; *Sphenopteris elongata,* Carr.; *Thinnfeldia odontopteroides,* Morr., sp.; *Cyclopteris cuneata,* Carr.; *Tæniopteris Carruthersi,* Ten. Woods; *Cardiocarpum australe,* Carr. Upper Mesozoic coal beds.

Mount Victoria, near Bowenfels, New South Wales.—*Thinnfeldia odontopteroides,* Feistm.; *Macrotæniopteris wianamattæ,* Feistm. (according to Tenison Woods). Hawkesbury beds. Lower Mesozoic.

Wannon River, Victoria.—See Coleraine.

Mount Wingen, Liverpool Range, New South Wales.—*Glossopteris Browniana,* Bgt. Lower Coal Measures.

Wollongong, New South Wales.—*Glossopteris linearis,* M'Coy. Newcastle beds. ? Permian.

Mount Wyatt, S.W. of Bowen, Queensland.—*Lepidodendron nothum,* Ung. Upper Devonian.

PART III.—COMPARISON WITH OTHER COUNTRIES.

After having described the geological and palæontological relations of the Coal and Plant-bearing Series, it will be of interest to compare the various strata of Australia with similar ones in other countries, viz., in New Zealand, India, South Africa, and Afghanistan.

I.—NEW ZEALAND.

It is not necessary to quote the entire literature; the following are sufficient for our purposes:—

Hector (James, M.D., &c.) **On the Geological Formations of New Zealand, compared with those of Australia.**—*Jour. and Proc. Roy. Soc. N. S. Wales, Vol. XIII*, 1879, *pp.* 65–80.

Hutton (Capt. F. W.) **Sketch of the Geology of New Zealand.** *Quart. Journ. Geol. Soc., No.* 162, *pp.*, 191–220, 1885.

Ettingshausen (Baron C. von). **Beiträge zur Kenntniss der Fossilen Flora Neu Seelands.** *Denkschr. der K. Acad. der Wissenschaften zu Wien. LIII Bd.*, 1887, 52 *pp.*, 9 *Pls.*

This latter work, however, contains only the descriptions of the fossils from Tertiary and Cretaceous rocks.

The most important beds described by Messrs. Hector and Hutton are the Kaihiku beds (Hector), or Kaihiku Series (Hutton).

At the base of these are deposited beds with *Glossopteris*, and it appears that these Kaihiku Series would have to represent the Newcastle beds or Upper Coal Measures of New South Wales; and Dr. Hector correlated both these strata, assigning to them a Lower Permian age (Table on p. 69).

To say Permian in general would be, I think, more correct, because the Hawkesbury beds, which Dr. Hector correlates with his beds, comprised under Upper Permian (Table, p. 68), are, as we have shown, more naturally placed with the Trias. (Further on in the text the correlation is somewhat different.)

Dr. Hector writes (*loc. cit.*, p. 78):—"The presence of this (*Glossopteris*) and other fossil ferns associates this formation with the horizon of the

Newcastle Coal Measures in New South Wales, which is underlaid by marine strata at Stony Creek, on the Hunter, and at Wollongong by a remarkable group of fossils.

"It is remarkable that no equivalent beds to the latter have yet been discovered in the New Zealand sections, there being a great break between the *Glossopteris* beds and the next formation."

This next formation is the Maitai Series and the Te Anau Series, which according to Dr. Hector, have in Australia their undoubted equivalent in the Port Stephens beds, and in the calcareous diorites of Gympie, and probably in the limestones associated with greenstones south of Hobart.

Above the Kaihiku Series Dr. Hector places in the text, p. 75, the (*a*) Otapiri, (*b*) Wairoa, and (*c*) the Oreti Series, but under the heading Trias. The Otapiri Series is considered of the age of the Hallstadt beds of Europe. The Wairoa Series contains *Monotis salinaria*, var. *richmondiana*, Zittel; *Halobia Lommelli*, Wissm., &c.; but also plants—*Glossopteris*, *Zamites*, *Rhacophyllum*, &c.

The Oreti beds are said to include a remarkable conglomerate of enormous masses of crystalline rocks in a hard cementing matrix, and as the probable equivalents of this formation in Australia are placed the Wianamatta Shales and Hawkesbury Sandstone of New South Wales. By Capt. Hutton the whole series is considered Triassic, into which also the Kaihiku Series is included.

II.—INDIA.

In India there is especially the so-called Gondwána System, which has to be correlated with the coal and plant-bearing system in Australia.

For a long time the correlation of the Indian and Australian coal beds has been extensively discussed, but only lately it has been placed on a somewhat more sound footing.

I have only lately dealt with the subject tolerably in detail in a paper published this year in Prague,* from which I shall extract the following:—

"The coal and plant-bearing beds are chiefly deposited within the limits of the peninsula, only a small patch is deposited at the foot of the Himalaya in the Sikkim Province, south of Darjeeling (Dárjíling), and some of the highest beds are also represented in the Kach Peninsula, north-west of Bombay."

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* Über die pflanzen und Kohlenführenden Schichten in Indien (beziehungensw. Asien), Afrika, und Australien, und darin vorkommende glaciale Erscheinungen. Sitzungsb. d. Königl. böhm. Gesellsch. Wissenschaften, 1887.

In the above paper, as well as in the 2nd Part, Vol. IV, of my Gondwána Flora (1886), I have found it more convenient and natural to subdivide the whole coal and plant-bearing system, called the Gondwána System, into three divisions.

A.—Upper Division of the Gondwána System.[*]

Jabálpur Series.	Umia Group, Kach. Tripetty Sandstones. Chikiala Sandstones. Jabálpur Group. Bagra Group.
Intermediate Series.	Chari Group, of Kach. Denwa Group. Kota-Maleri beds. Sripermatur Group. Ragavapuram. Vemáveram. Utatúr plant beds.
Rájmahál Series.	Rájmahál Group—Atgarh Sandstone. Sironcha Sandstone. Pachmári Sandstones. Dubrájpur Group.

This Upper Division is especially characterized by plant remains, such as *Gleichenia*, *Dicksonia*, *Alethopteris (Asplenium)*, *Thinnfeldia*, *Macrotæniopteris*, *Angiopteridium*, *Pterophyllum*, *Anomozamites*, *Ptilophyllum*, *Otozamites*, *Cycadites*, *Palissya*, *Taxites*, &c. Also some animal remains occur in some beds of the Intermediate Series, such as *Ceratodus*, *Lepidotus*, *Tetragonolepis*, *Hyperodapedon*, *Parasuchus*, *Belodon*, &c. In the uppermost group (Kach Group) there are marine animals of uppermost Jurassic type, and a flora of Middle Jurassic character.

B.—Middle Division of the Gondwána System—some uncertain transitional beds.

Panchet Series.—Panchet Group. Almod beds.

Damuda Series.	Mángli shales. Kámthi Group. Raniganj Group. Bijori horizon. Ironstone shales. Motur horizon. Barákar Group.

The fossils of this division consist of animals and plants. The animal remains, especially in the Panchet Group, Mángli Shales and Bijori horizon, are represented by the genera *Estheria*, *Gonioglyptus*, *Pachygonia*, *Glyptognathus*, *Dicynodon*, *Epicampodon*, *Brachyops*, and *Gondwanosaurus*. Of plants the following genera are known :—*Schizoneura* (frequent), *Phyllotheca*, *Trizygia*, *Vertebraria* (numerous), *Alethopteris*, *Merianopteris*, *Macrotæniopteris*, *Palæovittaria*, *Glossopteris* (very numerous), *Gangamopteris* (rare),

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[*] This name, as well as those of the three Series of the Upper Division, have been introduced by me into the literature.

Belemnopteris, Sagenopteris, Pterophyllum, and *Platypterygium, Nöggerathiopsis,* and others.

C.—Lower Division of the Gondwána System.

Talchir Series. { Karharbári beds.
Talchir Shales } Talchir Group.
Conglomerate (boulder) bed

This division is the most important one, both from a palæontological and from a stratigraphical point of view. The fossils are represented by the following genera:—*Vertebraria* (rare), *Neuropteridium* (characteristic), *Glossopteris, Gangamopteris* (numerous), *Nöggerathiopsis* (numerous), *Voltzia, Samaropsis,* &c.

The Karharbári beds contain very good coal seams, and they are especially developed in the Karharbári Coal-field, Daltonganj Coal-field, and Mohpain Coal-field. I maintain that they represent a certain horizon. The Talchir Group consists in the upper layers of sandy and clayey schists of bluish-gray or olive-green colour, and sandstones. The lower portions contain a peculiar boulder bed, the origin of which is now generally explained by the action of ice. This boulder bed was somewhat more thoroughly described in 1856 from the Talchir Coal-field in Orissa,* and even at that time it was suggested that ice action participated in its deposition. In 1872 some boulders were found in this conglomerate in the Central Provinces which showed scratches like those caused by glaciers, and since then it was considered as a fact that the deposit was due to ice action. Only recently the nature of this conglomerate was again discussed by Mr. W. T. Blanford.† This boulder bed will chiefly serve us as means of comparison of the Indian with the Australian coal and plant beds.

It has been already shown that the conglomerates in Australia appear at the end of the Carboniferous Epoch and that the Newcastle beds are probably Permian. A similar correlation will have to take place with regard to India.

1. From a stratigraphical and physical point of view the Talchir boulder bed has to be correlated with similar boulder beds at the base of the Bacchus Marsh beds, and within the Marine strata. The age would therefore be about Upper Carboniferous.

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* W. T. and H. F. Blanford and W. Theobald. Mem. Geol. Survey India, Vol. I, Pt. 1.

† Records Geological Survey of India, 1887. Vol. XX, Pt. 1, p 49.

2. The next correlation will have to take place between the beds immediately above the boulder beds; that is between the Talchir Shales and Karharbári beds, Bacchus Marsh beds and Newcastle beds, which also show a similar general character of the fossil flora. The Newcastle beds being considered Permian also, the other strata mentioned will fall in about the same epoch.

3. Above the Newcastle beds in New South Wales there are the Hawkesbury-Wianamatta beds, and in India above the Talchir-Karharbári beds follows the Damuda-Panchet Series, and this, I should think, has to be correlated next.

For the above view there is a further corroboration from the relations in the Salt Range in the Punjaub. There is also in that series of strata a boulder bed the position of which was for a long time uncertain, until only recently it appears to have been made out with satisfactory certainty. In a recent number of the Records of the Geological Survey of India, Dr. Warth,[*] an officer in the salt mines in the Salt Range, has proposed a classification for the strata of the Salt Range Series, in which the crystalline boulder bed has been already before declared to be of "Upper Carboniferous age"; the Productus limestone is partly Carboniferous, but also Permian; the Ceratite bed, Triassic, &c. The crystalline boulder bed, in which ice scratched and polished blocks were found, has been correlated with the Talchir boulder bed; both would thus be of about the same age. The Productus limestone would be an approximate equivalent of the Talchir-Karharbári beds. The Ceratite beds would therefore represent the Damuda Series, and so on. With regard to the Australian strata they would follow in a similar order.

The relations may be represented in the following table:—

Australia.	India—Gondwána System.	India—Salt Range.	New Zealand.
Upper Mesozoic	Upper Gondwána	Jurassic.	
Wianamatta and Hawkesbury beds.	Damuda-Panchet Series (Middle Gondwána).	Ceratite beds	Otapiri beds, Wairoa beds, Oreti beds.
Newcastle beds	Talchir-Karharbári beds (Lower Gondwána).	Productus limestone	Kaihiku Series.
Lower Marine Series, with *boulder bed.*	Talchir boulder bed (ice-action).	*Crystalline boulder bed.*	
Lower Carboniferous			Maitai Series. Te Anau beds.
Devonian			

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[*] Vol. XX, Pt. 2, 1887, pp. 117-119.

III.—AFRICA.

In Africa it is especially the Karoo Formation in Southern Africa which is analogous to the Gondwána System in India, the coal-bearing beds in Australia, &c.

This Karoo Formation has been differently described by various authors. But from the most recent information by Jones,[*] Moulle[†] and Dunn,[‡] the relations appear to be the following:—

1. In South Africa there occur distinctly Palæozoic rocks, viz., Devonian and Carboniferous.

2. The Carboniferous Series contains plant remains such as occur in Europe, in the Coal Measures at Tulbágh, Lower Albany, &c.

3. Above these Carboniferous beds, further to the north, the Karoo Formation and Stormberg beds are deposited, contaning such fossils as occur in the middle (Damuda and Panchet Series) and upper division of the Gondwána System in India.

4. Between the Carboniferous beds and the Karoo Formation the Ekka beds are deposited, which consist of shales in the higher portion, and of a boulder bed—the so-called Dwyka Conglomerate.

5. According to some authors, as Tate, Griesbach, and Moulle, this portion is conformable to the overlying Karoo beds; while, according to others, as Dunn and Jones, it overlies conformably the Coal Measures, and is discordant to the Karoo Formation.

6. Whether the one or the other view be correct, so much is certain, that the Ekka beds are higher than the Carboniferous beds with coal plants, and thus, naturally, they cannot be older, probably they are younger than these.

7. The Ekka boulder bed or Dwyka Conglomerate is now generally admitted to have been formed by ice action, and this circumstance would certainly indicate very different conditions during its deposition from those which prevailed during the formation of the preceding coal strata. I consider the formation of this boulder bed to fall at the end of the Carboniferous Epoch, and thus the Upper Ekka beds to represent the Permian Epoch. It is, therefore, also quite natural that, just as in Australia, so in Southern Africa, the change of climate has caused a termination of the Carboniferous

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[*] Brit. Assoc. Report. Montreal, 1884. (Abstr. Geol. Mag., October, 1884, p. 476, &c.)

[†] Annales des Mines, 1885. Mars-Avril, 1885.

[‡] Various Reports of 1876, 1879, 1886, Cape Town. Also in Catalogue of Exhibits, Cape of Good Hope, Indian and Colonial Exhibition, London, 1886.

Flora, after which another flora of a different character took its place. There is, however, this difference, that in Australia the change appears to have taken place at an earlier date, because there we have only a Lower Carboniferous flora, after which *Glossopteris* appears; while in Africa we find still an Upper Carboniferous flora before the deposition of the boulder bed came on.

8. A second bed of conglomerate, which also is said to be due to ice action, is mentioned from the so-called Kimberley Shales above the Upper Ekka beds.

9. The Karoo Formation, as it is at present defined, comprises, therefore, the Kimberley Shales, together with the overlying sandstones, representing apparently the Koonap, Beaufort, and one portion of the previous Stormberg beds, where occurred the fossils mentioned by Tate, such as *Glossopteris, Rubidgea, Phyllotheca,* as well as the animal remains.

If we now look for analogies we shall find the following:—

(*a*) The Dwyka Conglomerate of the Ekka beds has to be correlated with the conglomerates and boulder beds at the base of the Talchirs in the Salt Range (below the Productus limestone), at the base of the Bacchus Marsh beds, and below the Newcastle beds, New South Wales. The Dwyka Conglomerate is, as we have seen, not older than "Upper Carboniferous" lying above strata with coal plants of the type of the Upper Coal Measures in Europe. In Australia the deposition seems to have set in somewhat earlier, and also in the Salt Range it appears of somewhat older date, underlying the Productus limestone, which, as it appears, represents also partly the Upper Carboniferous Epoch.*

(*b*) What lies directly above the Dwyka Conglomerate, viz., the Upper Ekka Shales, must be correlated with the respective beds above the boulder beds elsewhere, viz., with the Talchir-Karharbári beds in India, Bacchus Marsh beds in Victoria, and Newcastle beds in New South Wales; and the age of these would be about Permian. Equivalents of these would also be the upper portions of the Productus limestone, Salt Range, and also the Mersey beds of Tasmania.

(*c*) Consequently the Karoo Formation, the Damuda-Panchet Series, the Ceratite beds of the Salt Range, and the Hawkesbury-Wianamatta beds are also to be correlated.

(*d*) The further correlations higher up follow by themselves. The relations will be shown hereafter in a general table.

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* In Afghanistan, however, as we shall see, there are certain beds which Mr. Griesbach correlates with the Talchirs, and which overlie the Productus limestones, alternating in their lowest portion with the same.

IV.—AFGHANISTAN.

The geological relations of this country have been only recently made known, especially through the work done there by Mr. C. L. Griesbach, of the Geological Survey of India. Of interest for the present paper are his publications on the geological relations of Northern and Western Afghanistan and Khorassan.* In his last contribution to this subject—"Field Notes, No. 5, to accompany a Geological Sketch Map of Afghanistan and North-Eastern Khorassan"—there is (p. 96) a very detailed table of geological formations which have been made known in the various parts of Afghanistan. They represent the whole series from Carboniferous, through Permian (?), Trias, Jurassic, Cretaceous, &c., up to Upper Pliocene and Recent.

If we compare the descriptions of this author with the relations in the Peninsula of India and in the Salt Range, we find that although Mr. Griesbach has determined a group as Productus limestone, yet the other sequence of strata is materially different. For, even if the lowest beds of the Permo-Trias Series does, as we are told, partly alternate with the Carboniferous (Productus beds), yet the whole of it lies above the Productus limestone, and thus also the conglomerates and sandstones which would correspond with the Talchir Boulder bed; while in the Salt Range, as we have seen, the Crystalline Boulder Series is placed below the Productus limestone. The only way of explaining this contradiction would be to suppose that the deposition of the Productus limestone, as well as of the lowest beds of the Permo-Trias corresponding with the Talchir boulder bed, lasted a much longer time, and that perhaps the Productus limestone itself is partly older than in the Salt Range, so that the Crystalline Boulder Series in the Salt Range would correspond with the uppermost beds of the Productus beds in Afghanistan, when there the deposition of the conglomerates and sandstones had just set in; while the lower portions of the Productus limestone in the Salt Range (Upper Carboniferous) would correspond with the lowest strata of the plant beds in Afghanistan, alternating with the Productus beds there; the higher portions of the Productus limestone of the Salt Range with the Permian (Talchirs in India); the Ceratite beds with the Trias, &c., of Afghanistan.

From this it again follows that the Damuda-Panchet Series (Middle Gondwanas) in India, as in Afghanistan, is of Triassic age.

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* Rec. Geol. Survey of India, 1885, Vol. XVIII, Pt. 1, p. 57, &c. *Ibidem*, 1886, Vol. XIX, Pt. 1, p. 48, &c.; Pt. 4, p. 235, &c. *Ibidem*, 1887, Vol. XX, Pt. 2, p. 93, &c., map.

V.—TONKIN.

To conclude I shall shortly mention the peculiar relations of the fossil flora of the coal deposits in Tonkin. They have been described by Mr. R. Zeiller in several notes.[*] The great interest of this flora lies in the circumstance that apparently in the same beds there were found fossil plants of acknowledged Rhætic age (according to the European standard of geological sequence), together with such as are found in the various portions of the Gondwána System in India, and also in Australia and South Africa. The fossil plants came especially from two coal basins, viz., Hon-Gac (Hone Gay) and Ké Bao, which are separated by a ridge of Carboniferous limestone, upon which the strata of the coal basin are discordantly deposited. The fossils were:—

(*a*) From the Ké-Bao Basin, Tonkin—

Tæniopteris spathulata, M'Clell. (*Angiopteridium*, Schimp.), and var. *multinervis*, Old. and Morr. Also found in the Upper Gondwánas, India.

Palæovittaria Kurzi, Feistm. Also found in the Middle Gondwána (Raniganj Group), India.

Dictyophyllum Nilssoni, Schenk. A Rhætic species of Bavaria and Sweden.

Clathropteris platyphylla, Bgt. Rhætic, in Europe.

Glossopteris Browniana, Bgt. Also in the Middle and Lower Gondwánas (especially Damuda Series) of India; Upper and Lower Coal Measures of Australia, &c.

Pterozamites Münsteri, Schimp. Rhætic, Bavaria.

Nilssonia polymorpha, Schenk. Frequent in Rhætic Beds, in Europe.

Nöggerathiopsis Hislopi, Feistm. In the Middle and Lower Gondwána, in India; also in Tasmania.

(*b*) From the Hon-Gac (Hone Gay) Coal Basin, Tonkin—

Phyllotheca indica, Bunb. Middle Gondwána, India.

Asplenites Rœsserti, Presl. Rhætic, in Europe.

Tæniopteris (Angiopteridium) spathulata, M'Clell., and also var. *multinervis*, Oldh. and Morr. Upper Gondwána, in India.

Tæniopteris (Angiopteridium) ensis, Oldh. and Morr. Upper Gondwána, in India.

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[*] "Sur la Flore fossile des Charbons du Tong-King." Compt. Rend. Acad. Sciences, 24 Juillet, 1882—"Examen de la Flore fossile des Couches de Charbon du Tong-King." Ann. d. Mines, Sept.-Oct., 1882, Pl. X-XII; Bull. Soc. Géol. France, 3d sér., t. XIV, Avril, 1886, et Juin, 1886.

Macrotæniopteris Feddeni, Feistm. Middle Gondwána, India.
Woodwardites microlobus, Schenk. Rhætic, in Europe.
Polypodites Fuchsi, Zeiller.
Dictyophyllum acutilobum, Schenk. Frequent in Rhætic beds, in Europe.
Clathropteris platyphylla, Brongt. Rhætic, in Europe.
Pterophyllum æquale, Nath. Rhætic, in Europe.
Pterozamites Münsteri, Schimp. Rhætic, Europe.
Anomozamites inconstans, Schimp. Rhætic, Europe.
Nilssonia polymorpha, Schenk. Rhætic, Europe.
Otozamites rarinervis, Feistm. Upper Gondwánas, India.
Podozamites distans, Braun. Rhætic, Europe.
Nöggerathiopsis Hislopi, Bunb. sp. Middle and Lower Gondwánas, India.
Cycadites Saladini, Zeiller.

There are, therefore, nine species of Gondwána plants (various horizons) found, together with ten species of Rhætic plants of Europe and elsewhere. Mr. Zeiller considers this flora to be of Rhætic age, and to occupy besides, a position between the Upper and Middle Gondwána of India, which again shows that the position I assigned to the Damuda-Panchet Series was correct.

These are about all the various formations and systems of interest to be compared with the Australian rock groups.

SUMMARY.

If we now sum up we may draw the following conclusions :—

1. In Australia, India, South Africa, Tonkin, and also in Afghanistan there appear to have prevailed towards the close of the Carboniferous Epoch different relations from those in Europe, at least with regard to the plant remains.

2. In Australia there occurs in strata belonging to the series of marine beds of the Middle and Upper Carboniferous age, a flora containing the genera *Glossopteris*, *Phyllotheca*, and *Nöggerathiopsis*, which hereafter in

higher beds become more numerous. In Africa there is on about the same horizon a true Coal Measure flora, while in India, below the Gondwána System, there is nothing to show distinctly a Carboniferous age of the respective beds. The Productus limestone, however, in the Salt Range, and the Productus beds in Afghanistan, are, partly at least, representatives of the above Carboniferous beds.

3. The most important phenomenon within these various deposits is the conglomerates or boulder beds,* about the origin of which there is now the general opinion that they have been deposited through the action of ice in one form or other, the manner of deposition being such as to force upon one this kind of explanation, and besides this there have been found polished and ice scratched pebbles and boulders within these beds. This circumstance would, of course, indicate a rather general change of climatic conditions over Australia, portions of Africa, India, &c., towards the close of the Carboniferous Epoch. But I do not think that it was contemporaneous over that whole region, and it appears to me that it set in first in Eastern Australia (New South Wales), destroying the Carboniferous flora at an early date, while in Southern Africa we find still a Carboniferous or Coal Measures flora of a higher stage, and only hereafter the change of climate appears to have taken place there.

4. When the conditions of ice action ceased there appeared in Africa, India, Victoria, New South Wales, &c., a luxuriant flora of a peculiar character, which was, however, foreshadowed by a few forms in the Lower Coal Measures in New South Wales. In this period falls the deposition of the Karoo Formation in Africa, the Gondwána System in India, Newcastle beds, &c., in New South Wales, Bacchus Marsh beds in Victoria, and so on. Several of these deposits contain thick and important coal seams.

5. The age of the various deposits can be fixed with approaching certainty, or at least with great probability when we start from the horizon of the boulder beds. Assuming these to fall towards the close of the Carboniferous Period, then the age of the beds above and below can be approximately fixed.

The following General Tabular View may represent all the relations discussed in the preceding pages.

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* [See foot-note, p. 28.– R. E., jun.]

General Table, comparing the various Formations.

Europe.		Age.	Australia.			Tasmania.	New Zealand.
			New South Wales.	Victoria.	Queensland.		
Mesozoic.	Jurassic.	Upper Mesozoic.	1. Upper Mesozoic beds. Clarence River Series.	1. Carbonaceous beds ...	1. Carbonaceous beds ...	1, 2. *Upper Coal Measures.*—Jerusalem, Spring Hill, Newtown, &c. *Alethopteris australis, Thinnfeldia odontopteroides, Sphenopteris elongata, &c.*	1. Jurassic, &c.
	Triassic.	Lower Mesozoic.	2. Wianamatta-Hawkesbury beds. (Conglomeratic boulder bed in the latter.) Plants and ganoid fishes.	2. ?	2. ?		2. (*a*) Otapiri beds. (*b*) Wairoa beds. (*c*) Oreti beds.
Palæozoic.	Permian.	Permo-Carboniferous.	3. Newcastle beds (Upper Coal Measures), Plants numerous — *Phyllotheca, Vertebraria, Glossopteris, Gangamopteris, Nöggerathiopsis, &c.* Glossopteris beds.	3. Bacchus Marsh Sandstone. *Gangamopteris* beds.	3, 4. Coal Measure Series— (*a*) Upper or mainly Freshwater Series. *Glossopteris* in abundance. (*b*) Marine beds, with *Glossopteris.* (*c*) Unfossiliferous beds	3, 4. *Lower Coal Measures.* (*a*) Upper Marine beds, with plants. *Gangamopteris.* (*b*) Tasmanite bed. (*c*) Lower Coal Measures, with *Glossopteris Gangamopteris, &c.* (=Mersey beds).	3. Kaihiku Series (*Glossopteris*).
	Middle and Upper Carboniferous.		4. Marine Series— (*a*) Upper Marine beds. (*b*) Lower Coal Measures (*Glossopteris*). (*c*) Lower Marine beds. Boulder beds, showing signs of ice action.	4. Bacchus Marsh Conglomerate. Showing signs of glacial action.		(*d*) Lower Marine beds.	4. ?
	Lower Carboniferous.	Lower Carboniferous.	5. Lepidodendron beds (Smith's Creek, &c.)	5. Avon River Sandstone, with *Lepidodendron.*	5. Bobuntungen beds (Drummond Range).	5. ?	5. Maitai Series. Te Anau beds.
	Devonian.	Devonian.	6. Goonoo Goonoo beds (*Lepidodendron nothum,* Ung.)	6. Iguana Creek beds ...	6. Mount Wyatt beds (*Lepidodendron nothum,* Ung.)	6. Fingal soft slates. Freshwater. No plants but *Anodonta Gouldii.*	

Compiled by Dr. O. Feistmantel, 1887.

South Africa.	India.		Afghanistan.	Tonkin.
	Gondwána.	Salt Range.		
Uitenhage Formation. Stormberg beds.	*Upper Gondwánas.*—Jabálpur to Rájmáhal Series. Chiefly plants; marine animals in the highest group.	Jurassic.		Upper Gondwána plants. Together in the same beds.
Karoo Formation, with Kimberley Shales and a conglomerate at base. (Plants and animals.)	*Middle Gondwánas.*—Panchet and Damuda Series. Plants (chiefly *Glossopteris*, &c.) and coal seams; also animals.	Ceratite beds.	*Halobia Lommeli* and plant beds. } Trias. Permo-Trias.	Rhætic plants. Middle and Lower Gondwána plants.
Ekka beds (with plants). 4. Dwyka Conglomerate (showing signs of ice action). 4a. Carboniferous beds, with a Coal Flora = Coal Measures.	*Lower Gondwánas.*—Karharbári beds, Talchir Group. Plants (chiefly *Gangamopteris*) and coal seams. Talchir boulder bed, showing signs of ice action.	Permo-Carboniferous. Productus limestone. Crystalline boulder bed (glacial).	Plant shales. Permian ? Plant beds, alternating with Productus beds. Productus beds. Permo-Carboniferous.	Carboniferous rocks.
	Vindhya Formation.			

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Sydney: Charles Potter, Government Printer.—1890.

PLATE I.

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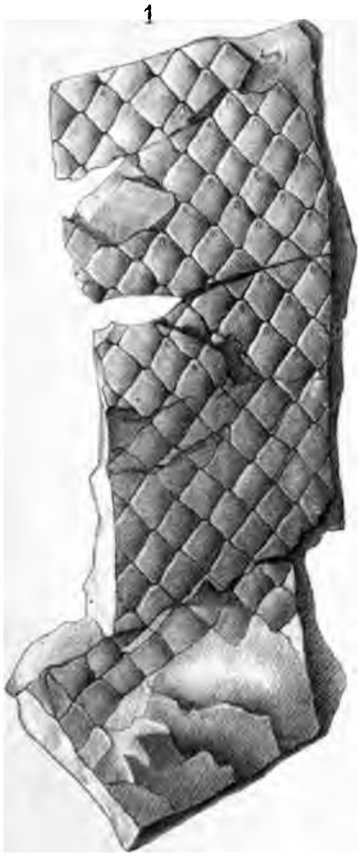

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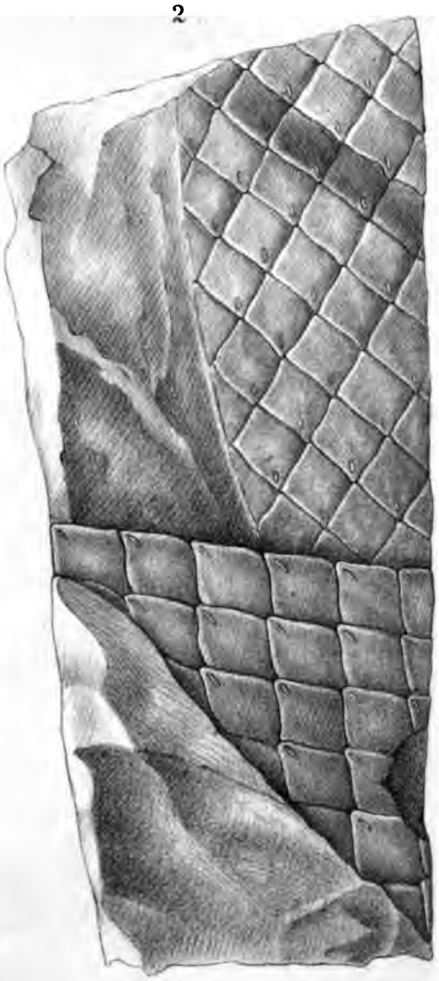

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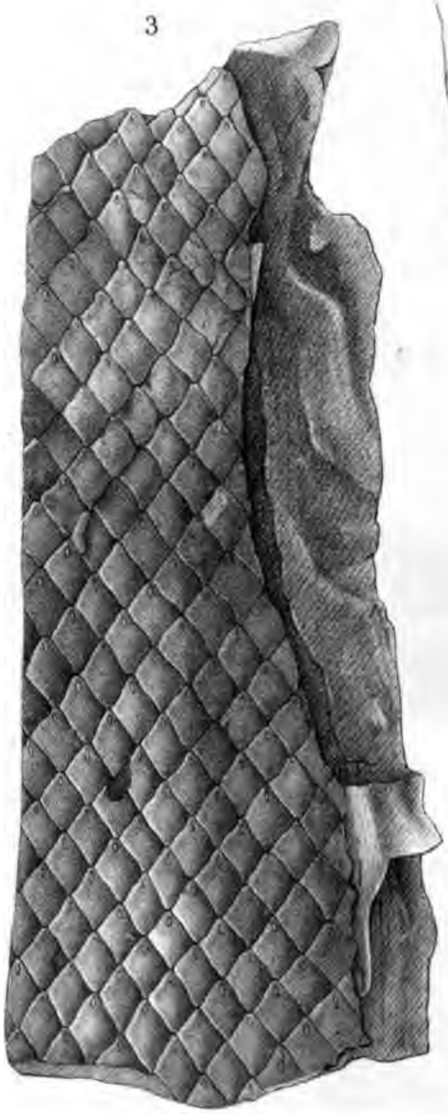

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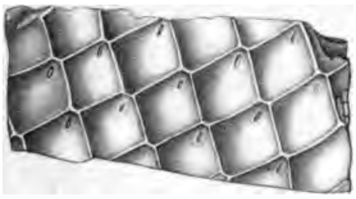

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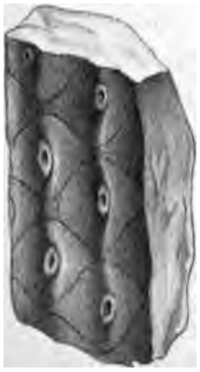

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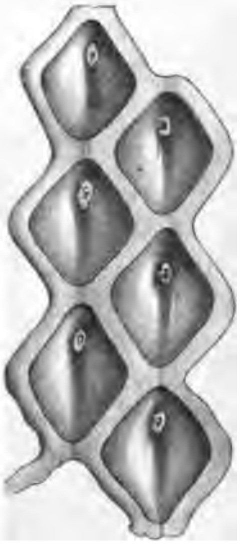

Autor delt. Artist Anst.v Th Fischer Cassel.

1-4. **Lepidodendron nothum** Ung. (Carruth.) 5. 6. **Lepidodendron australe** Mc'Coy.

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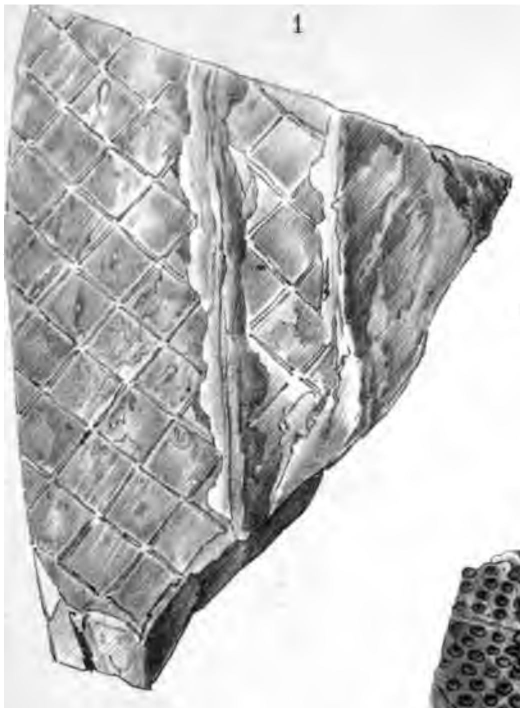

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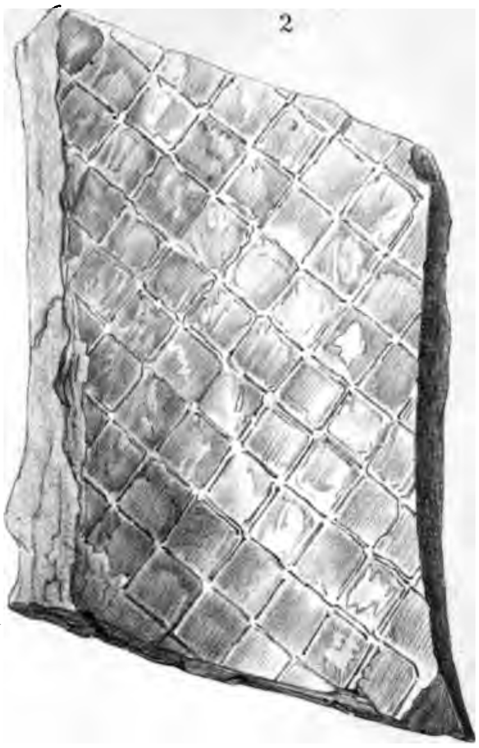

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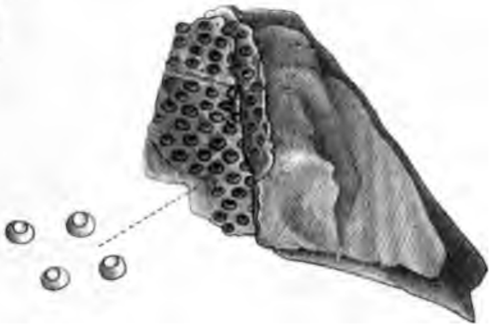

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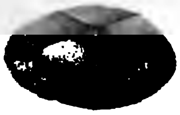

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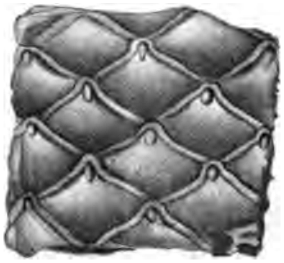

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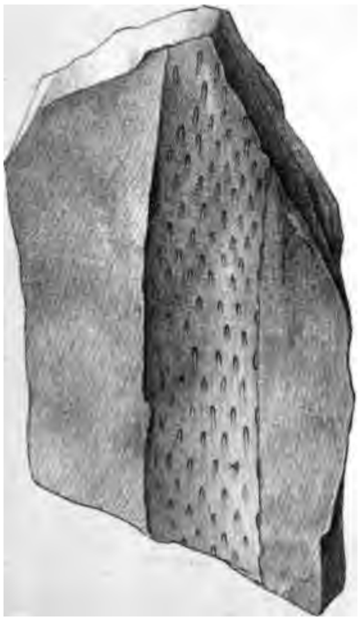

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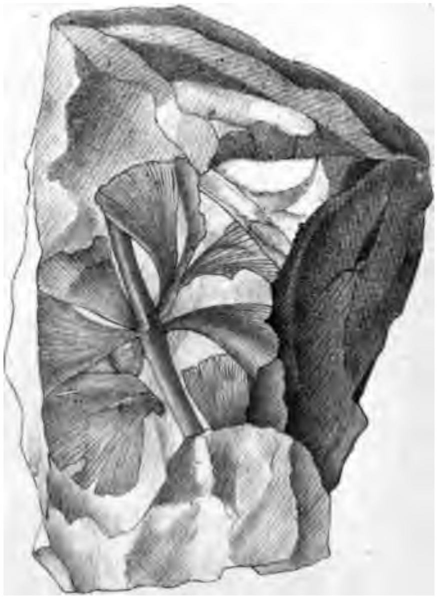

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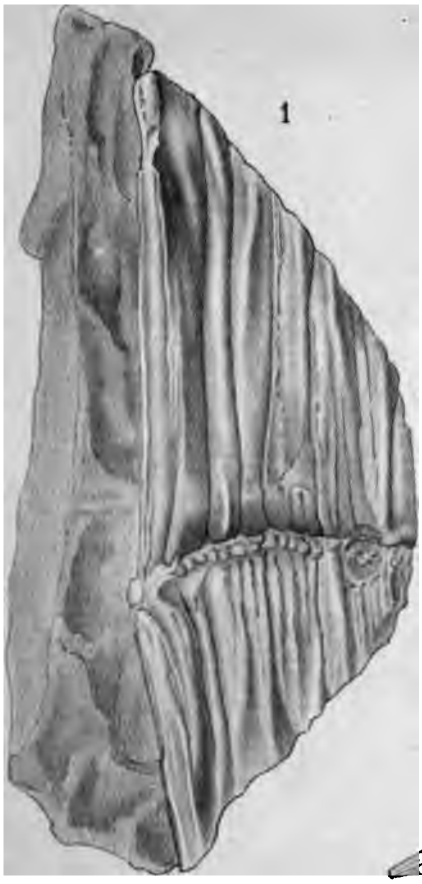

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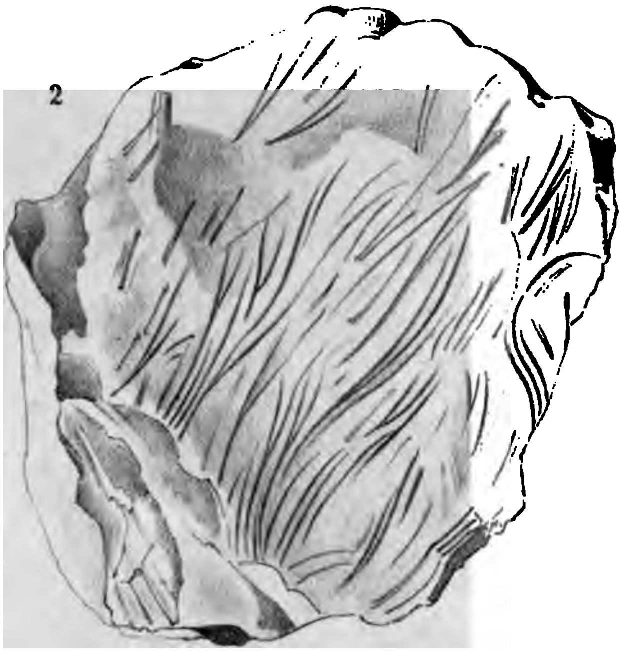

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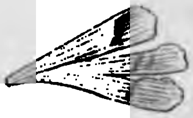

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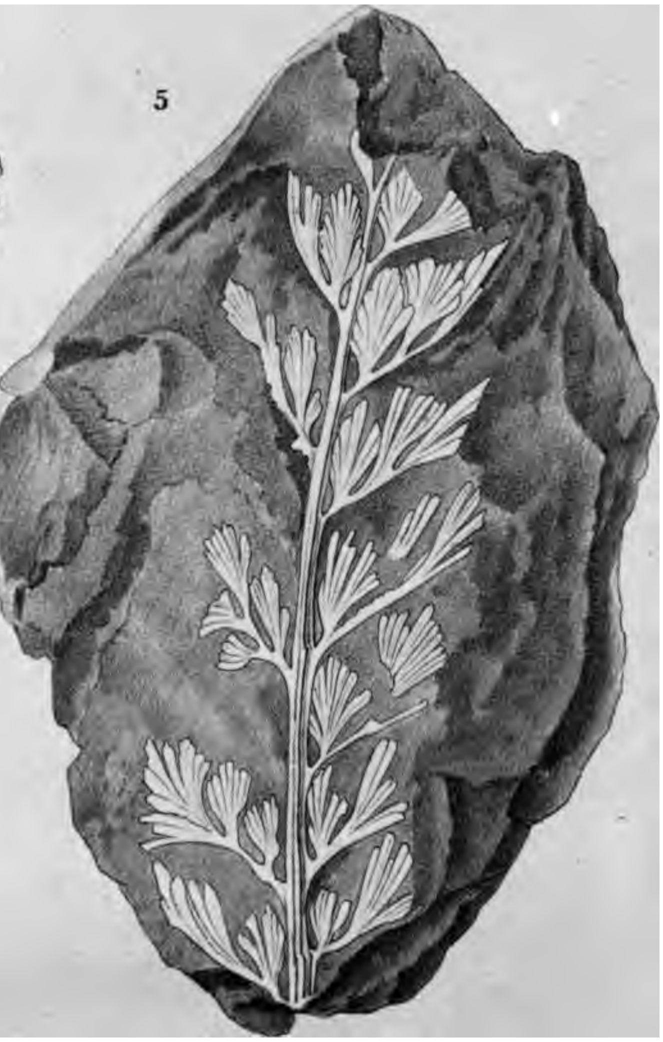

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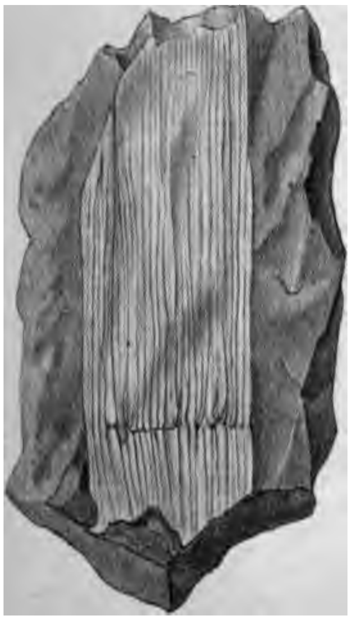

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1-3. Calamites radiatus Bgt. 4. Rhacopteris inaequilatera (?) Göpp. 5. Rhacopteris septentrionalis Feistm.

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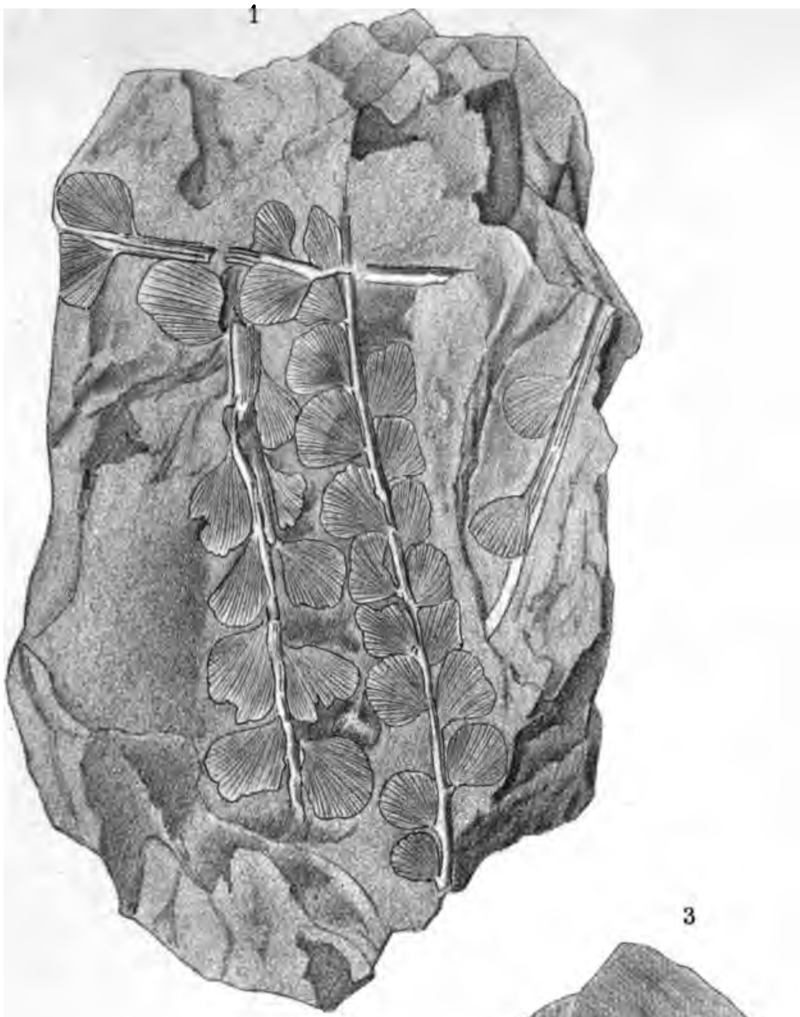

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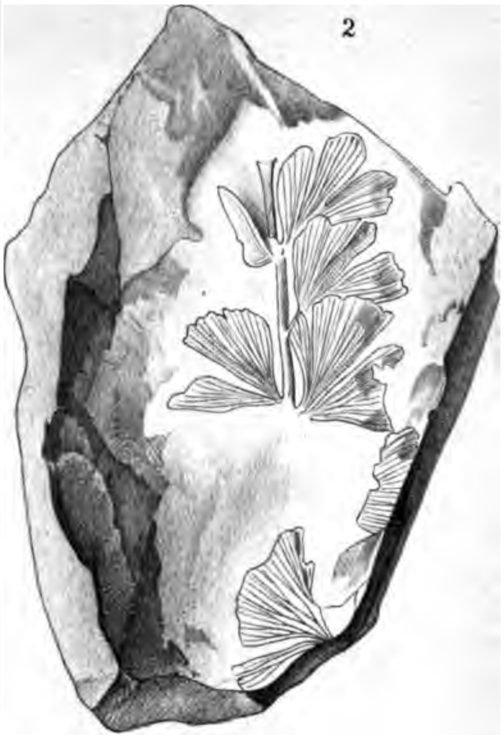

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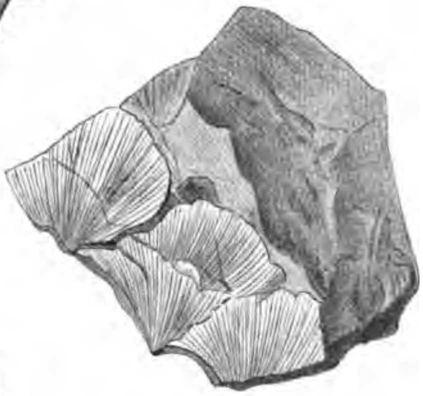

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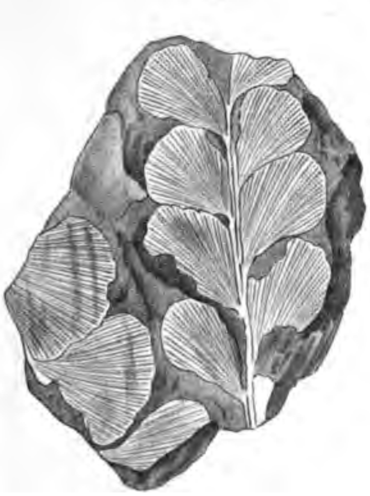

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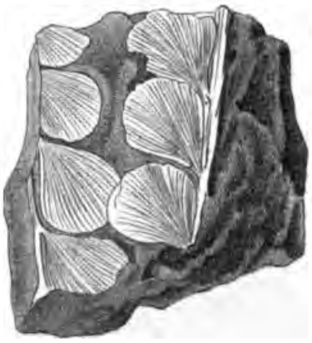

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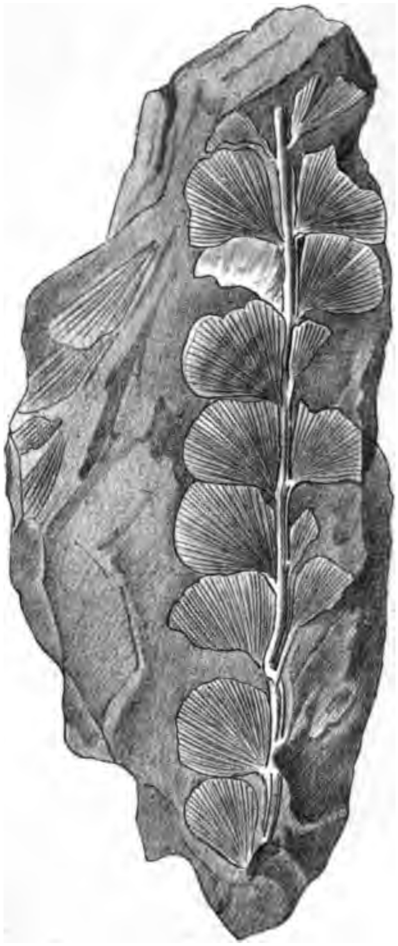

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1-6. Rhacopteris inaequilatera Göpp. sp. 3. is from Arowa, N. S. Wales.

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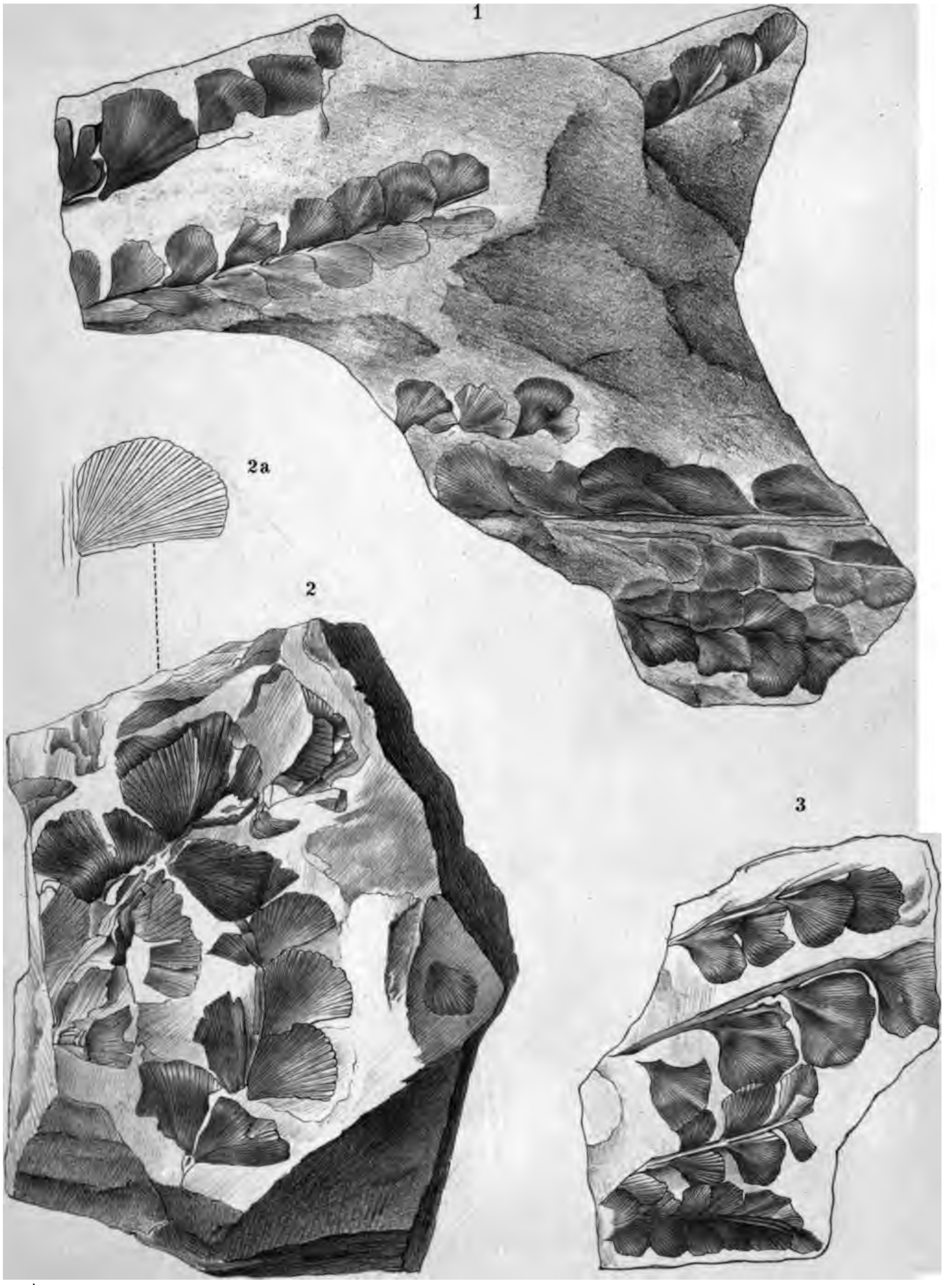

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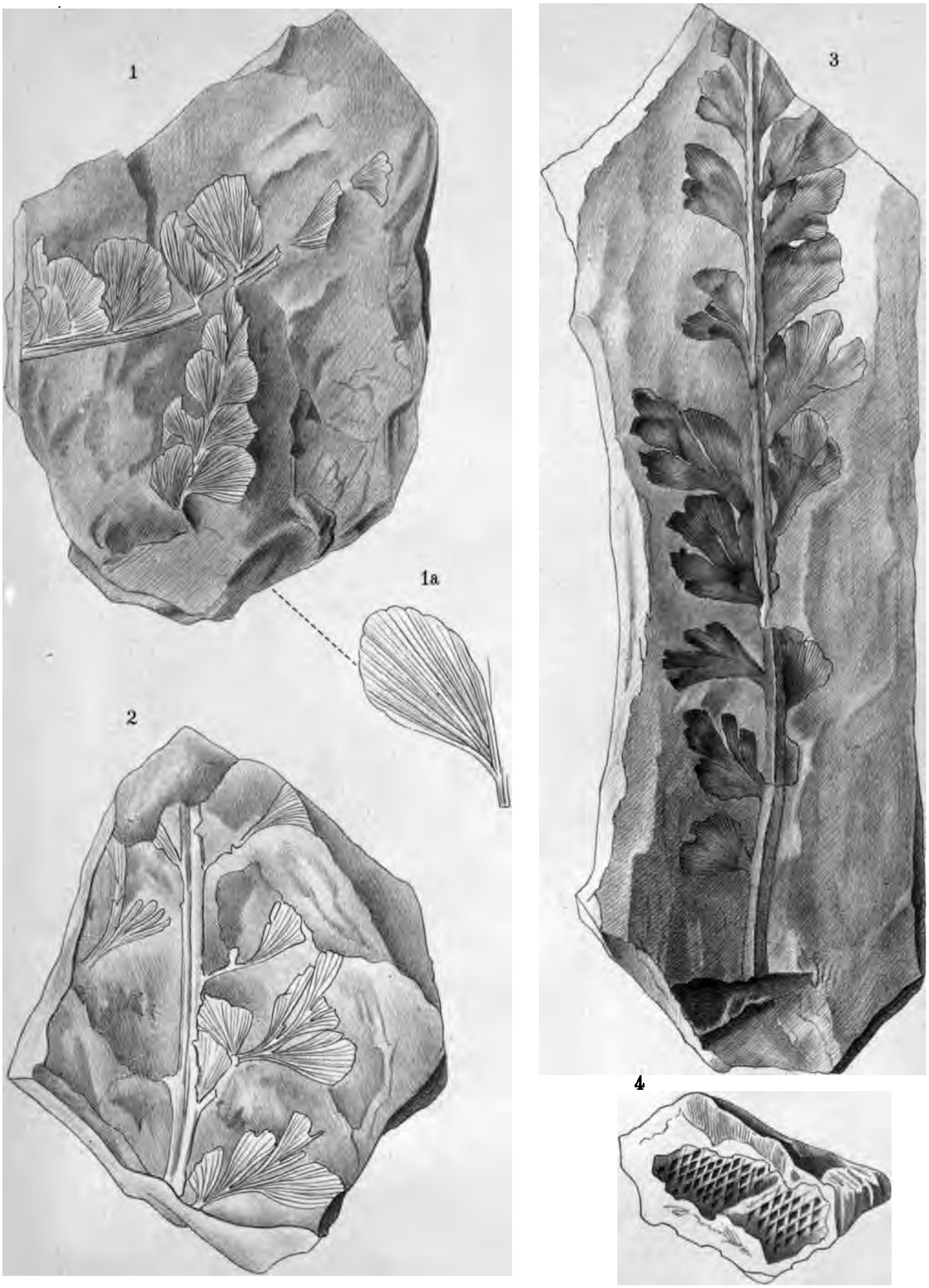
Lower Carboniferous.



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1. Rhacopteris inaequilatera Göpp. sp. From Arowa; N. S. Wales. 1a. Enlarged leaflet. 2. Archaeopteris Wilkinsoni Feistm. 3. Rhacopteris intermedia Feistm. 4. Lepidodendron dichotomum Stbg.

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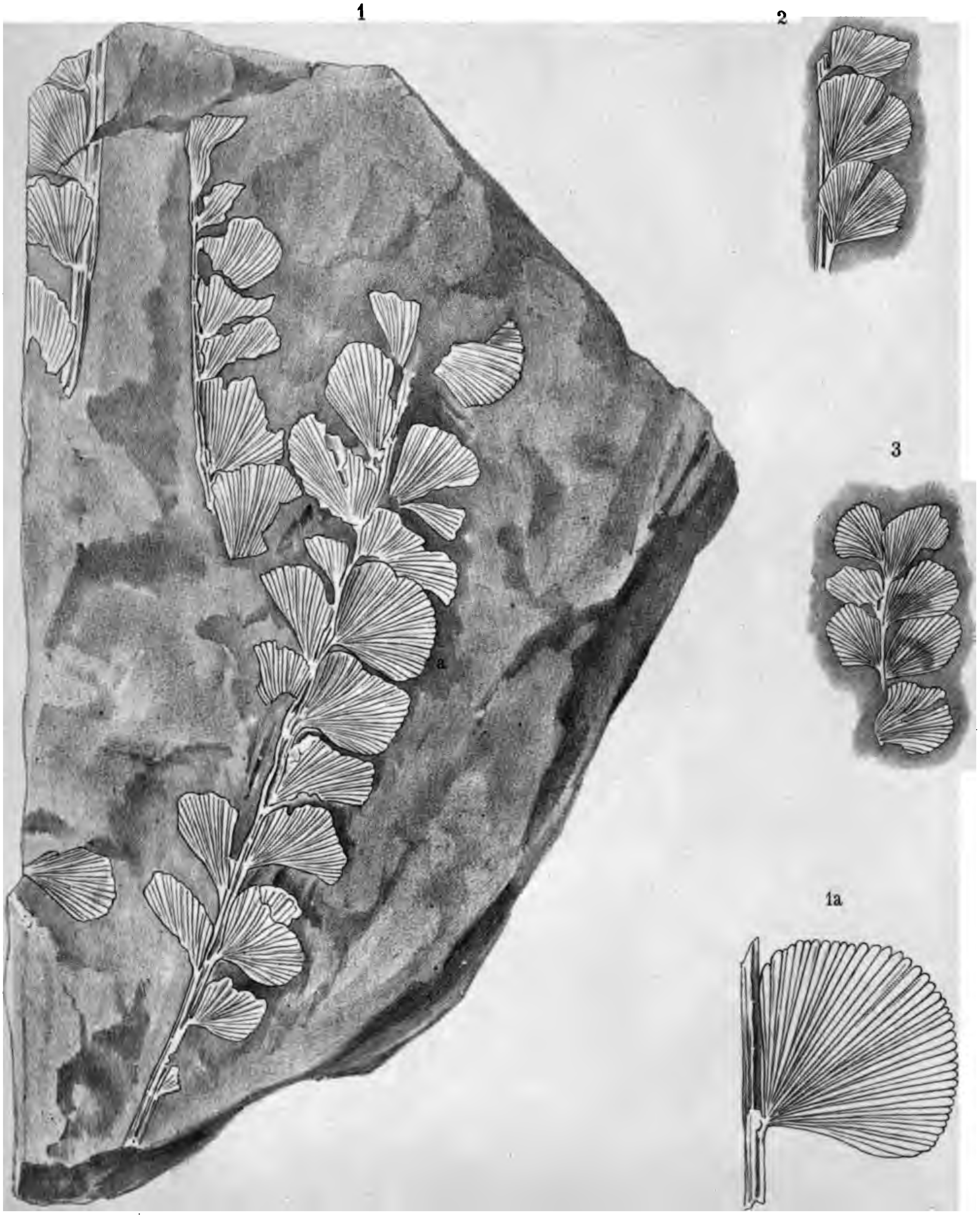
Smith's Creek, near Stroud, New South Wales. Lower Carboniferous.



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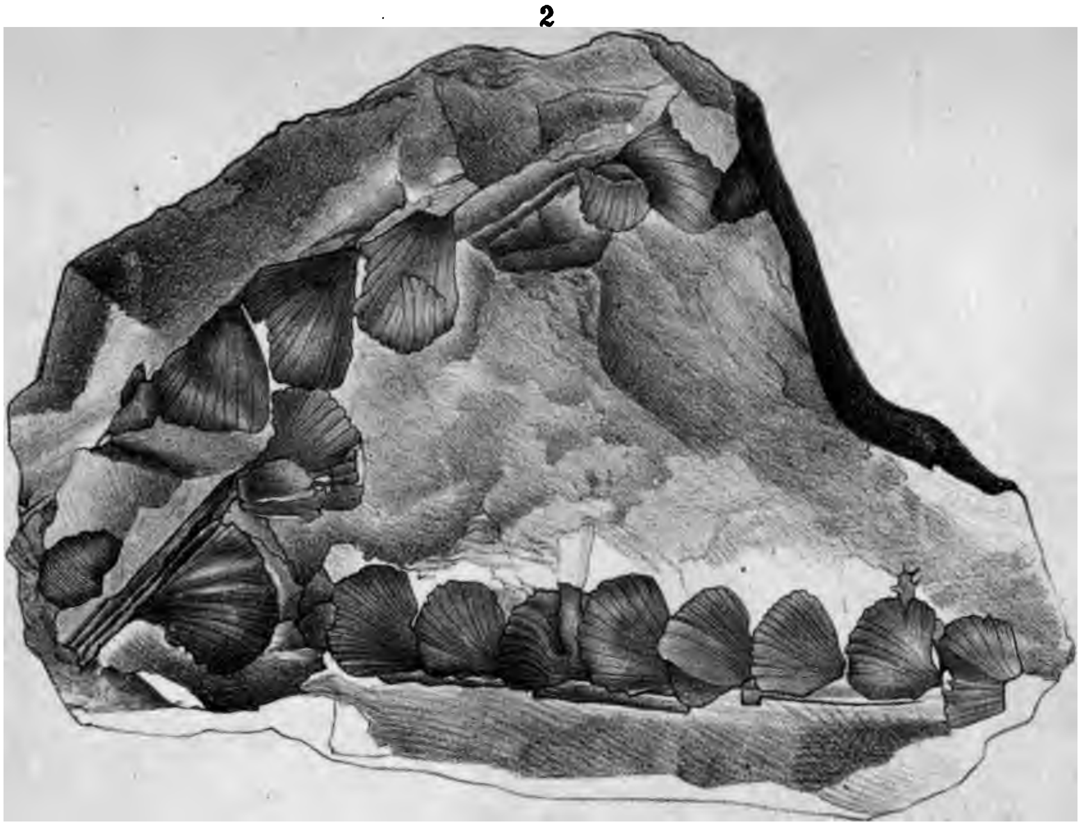
Lower Carboniferous.

2



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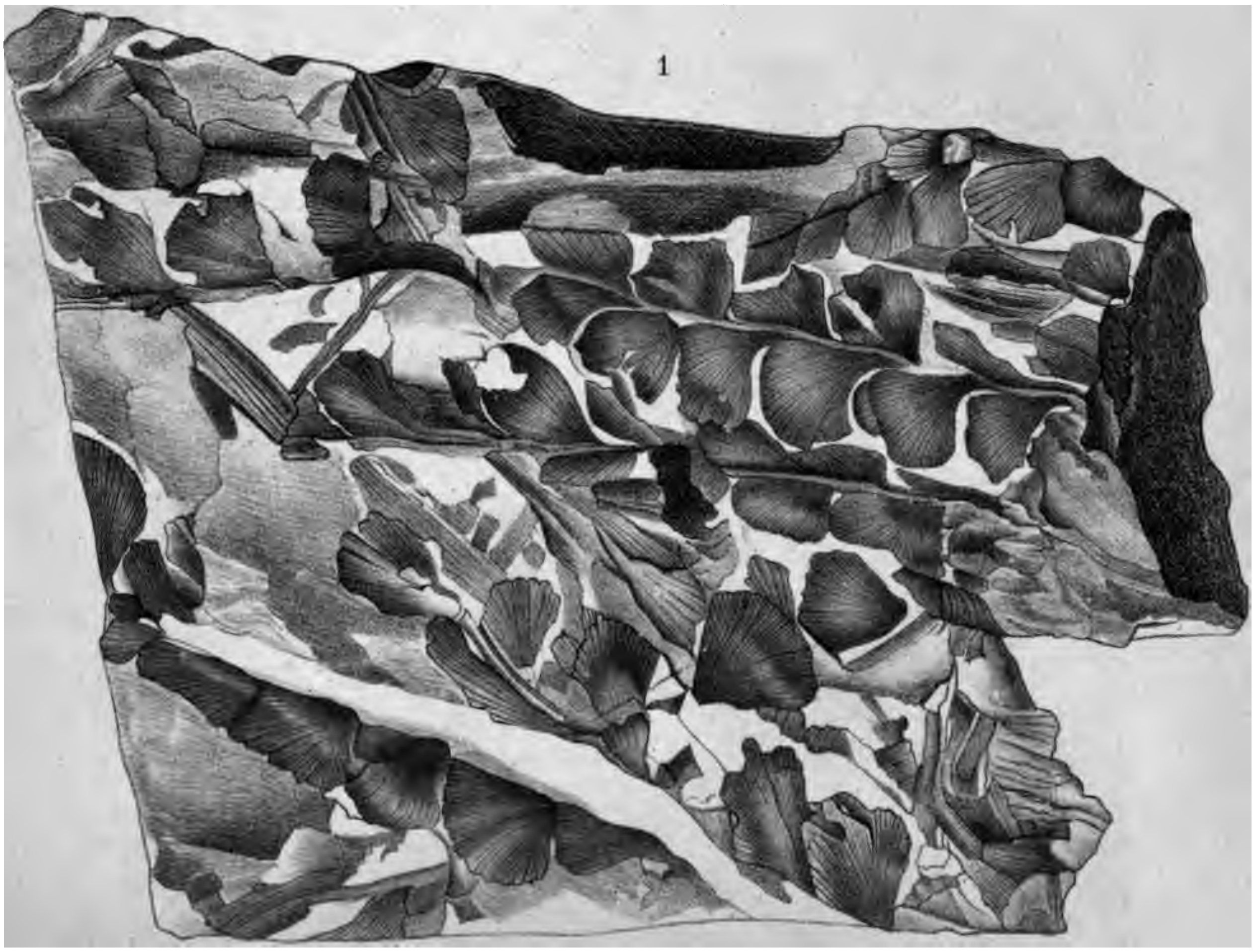

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1.2. **Rhacopteris inaequilatera** Göpp.

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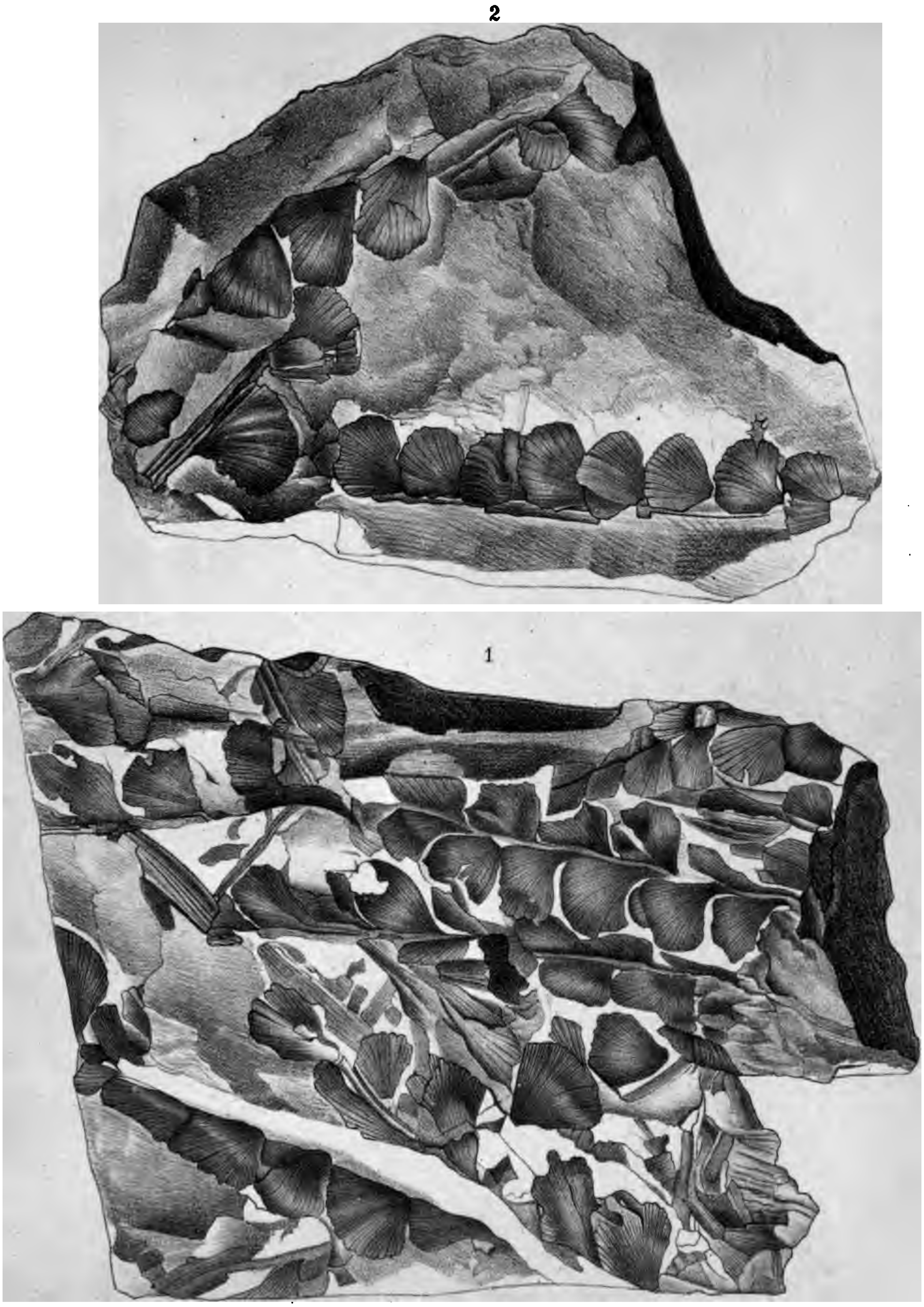
Lower Carboniferous.



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1.2. Rhacopteris inaequilatera Göpp.

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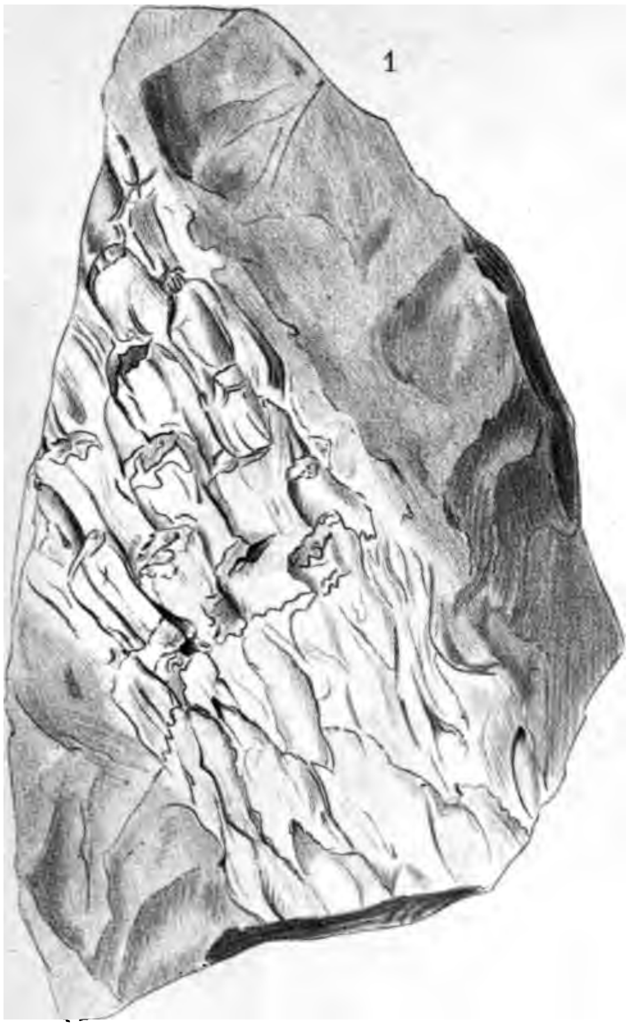
Lower Carboniferous.

1



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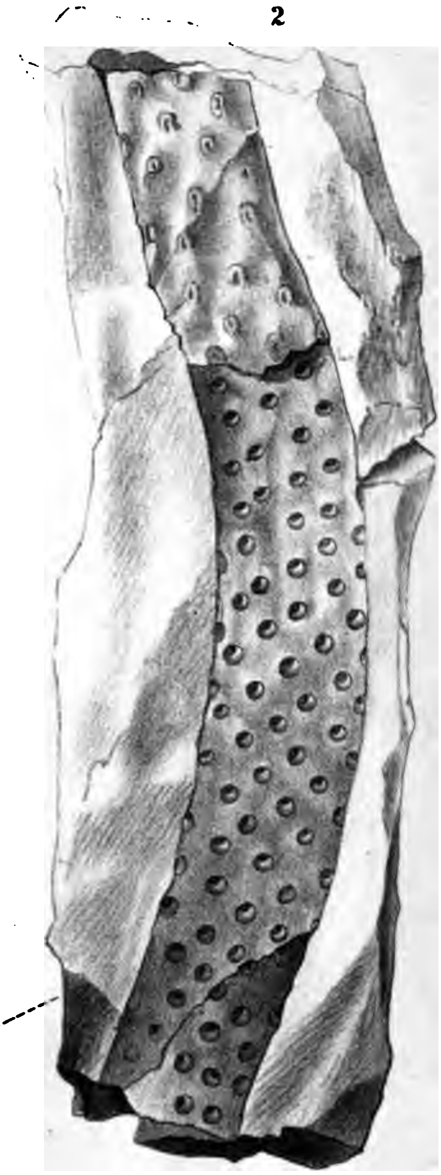

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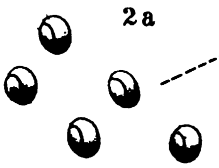

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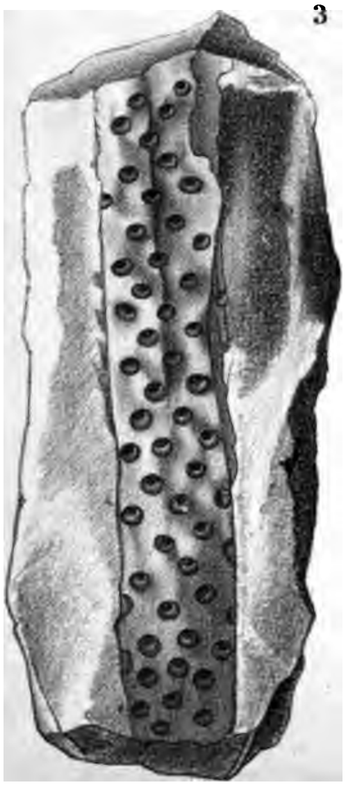

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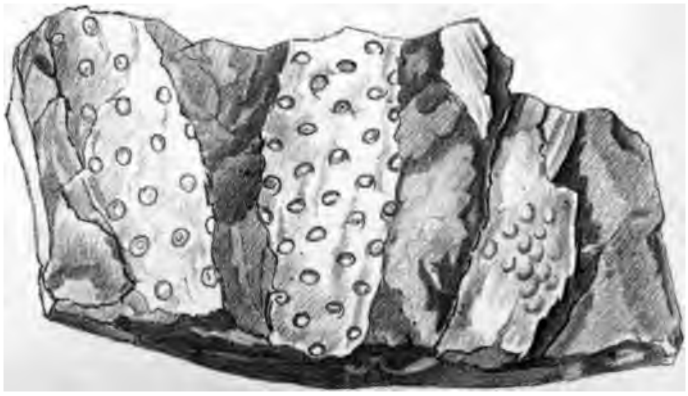

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1. Lepidodendron comp. Volkmanianum Stbg. 2-4. Cyclostigma australe Feistm.

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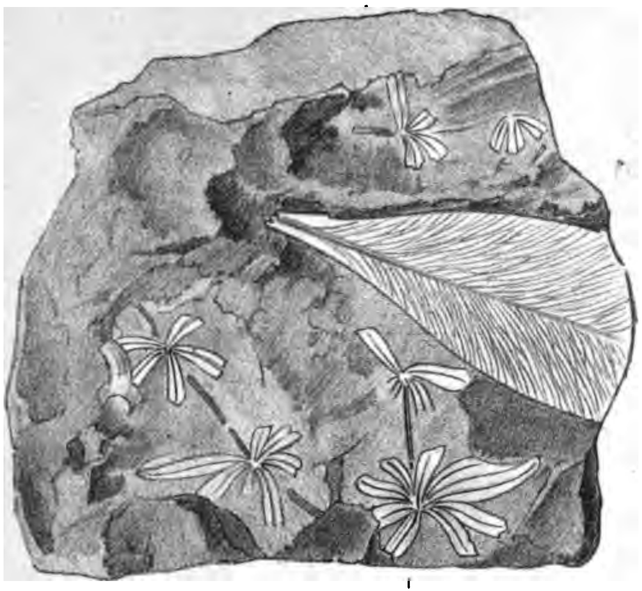

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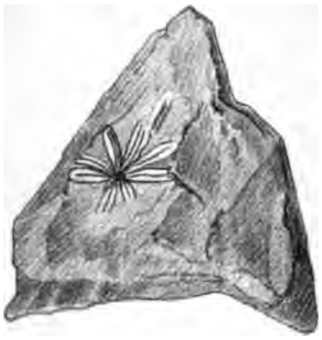

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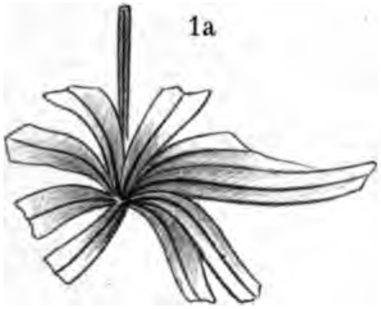

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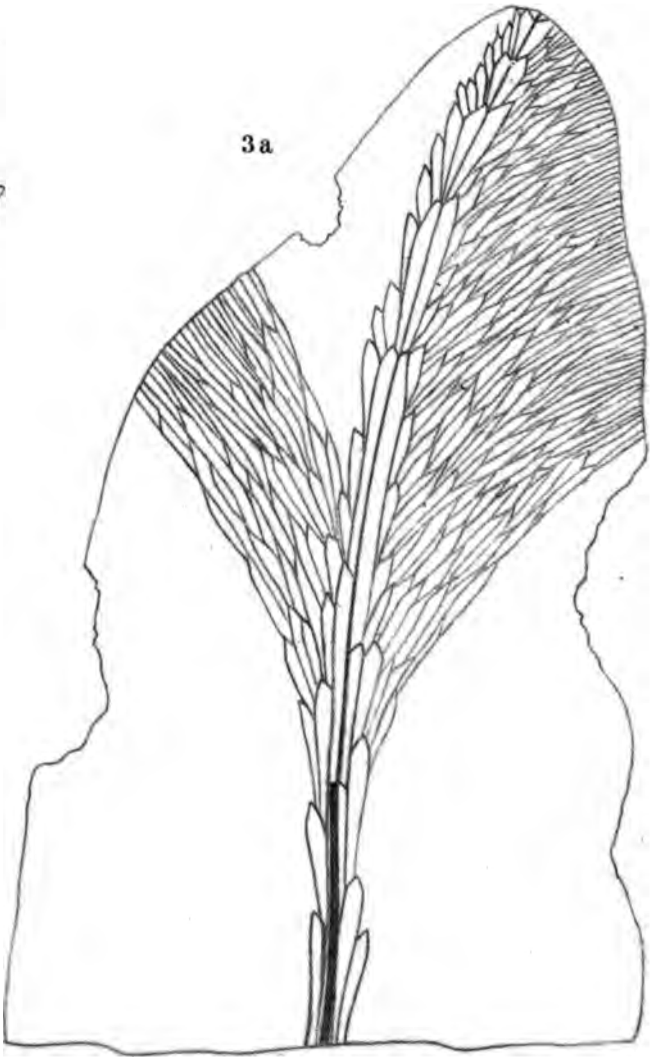

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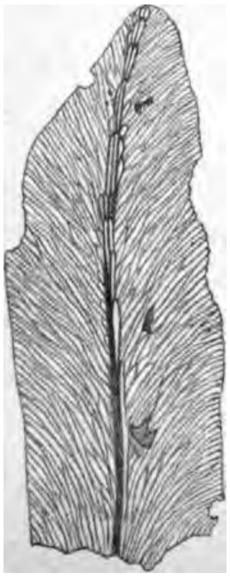

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1.2. Annularia australis Feistm. 3.3a. Glossopteris elegans Feistm.

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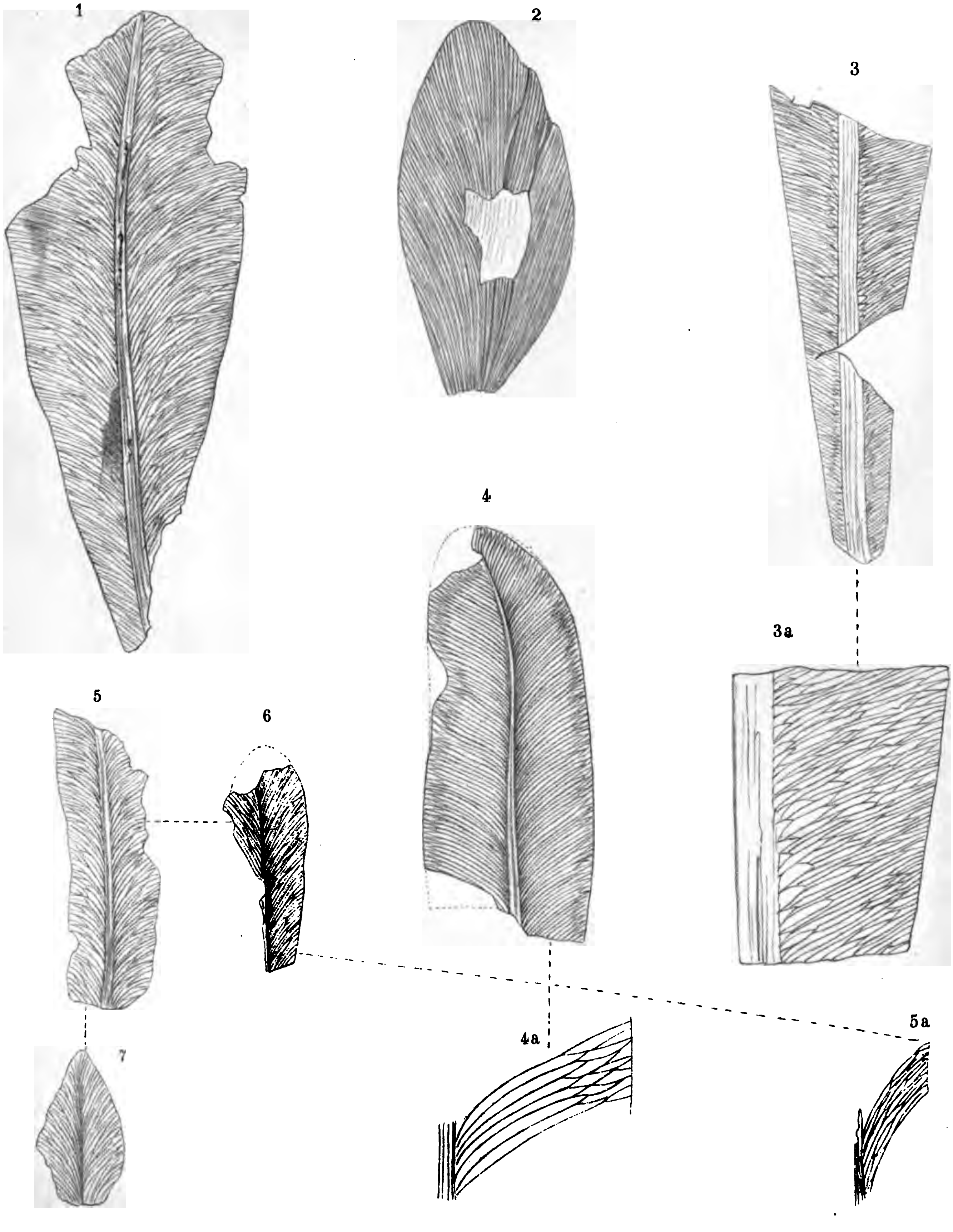
Lower Coal Measures.



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1. Glossopteris browniana Bgt. 2. Nöggerathiopsis prisca Feistm. 3. Glossopteris primaeva Feistm.
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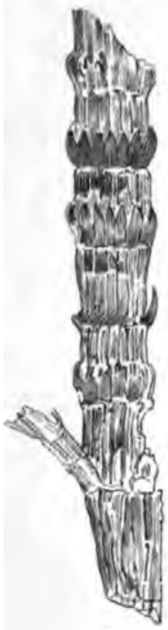

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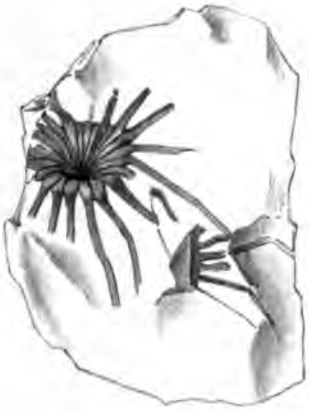

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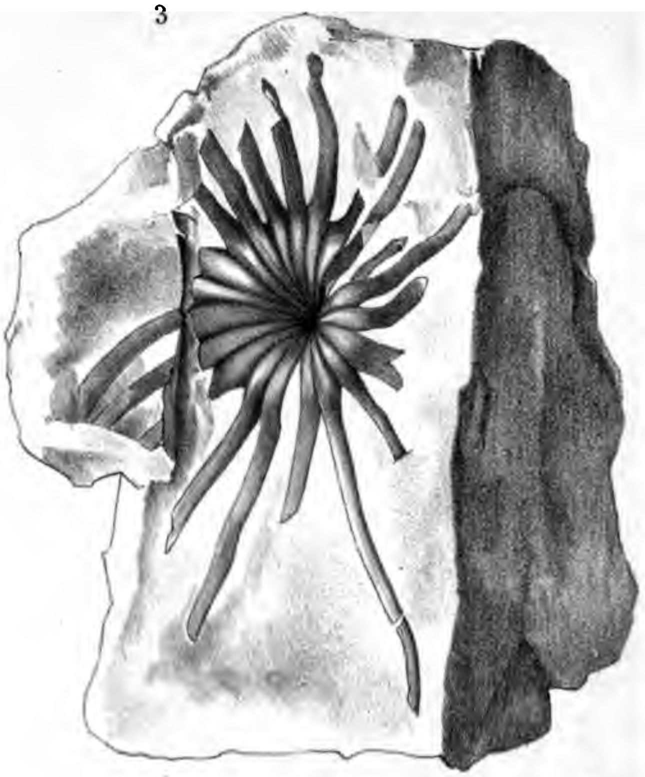

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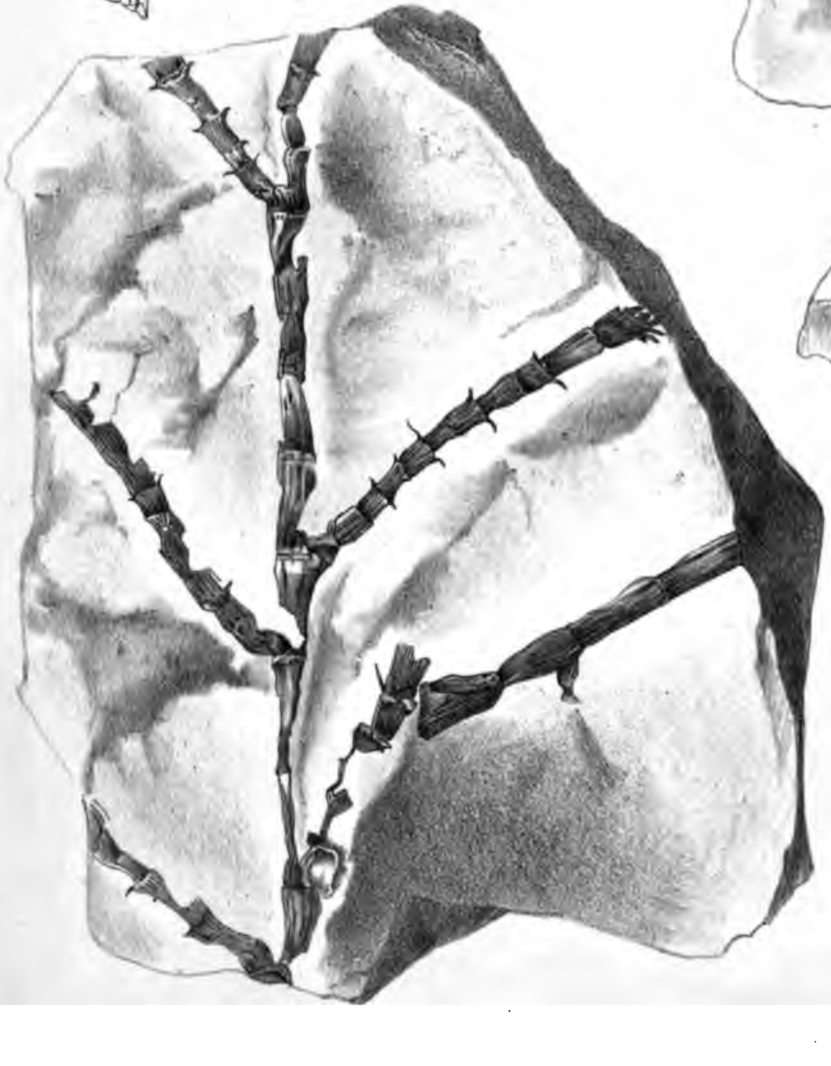

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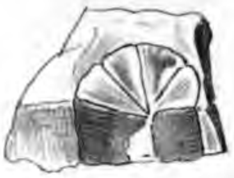

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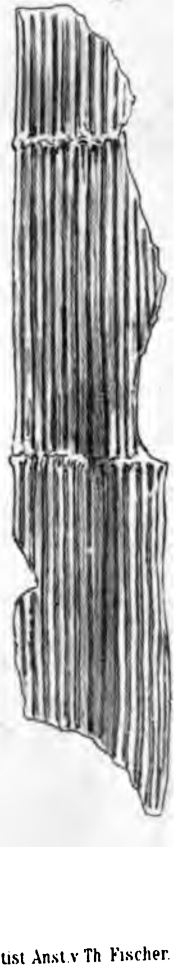

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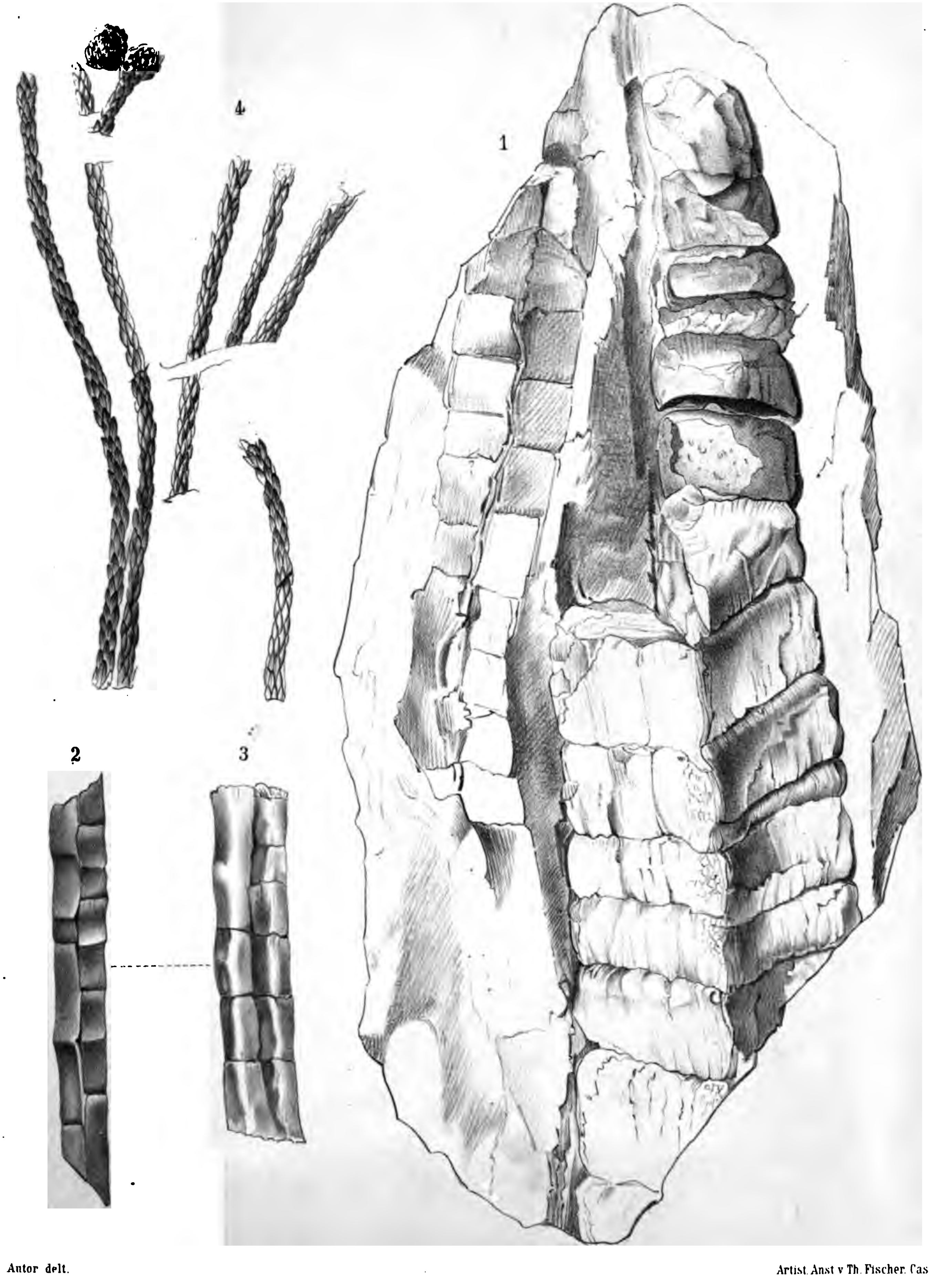

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1. Vertebraria australis Mc'Coy. 2. 3. Clasteria australis Dana. (Vertebraria).
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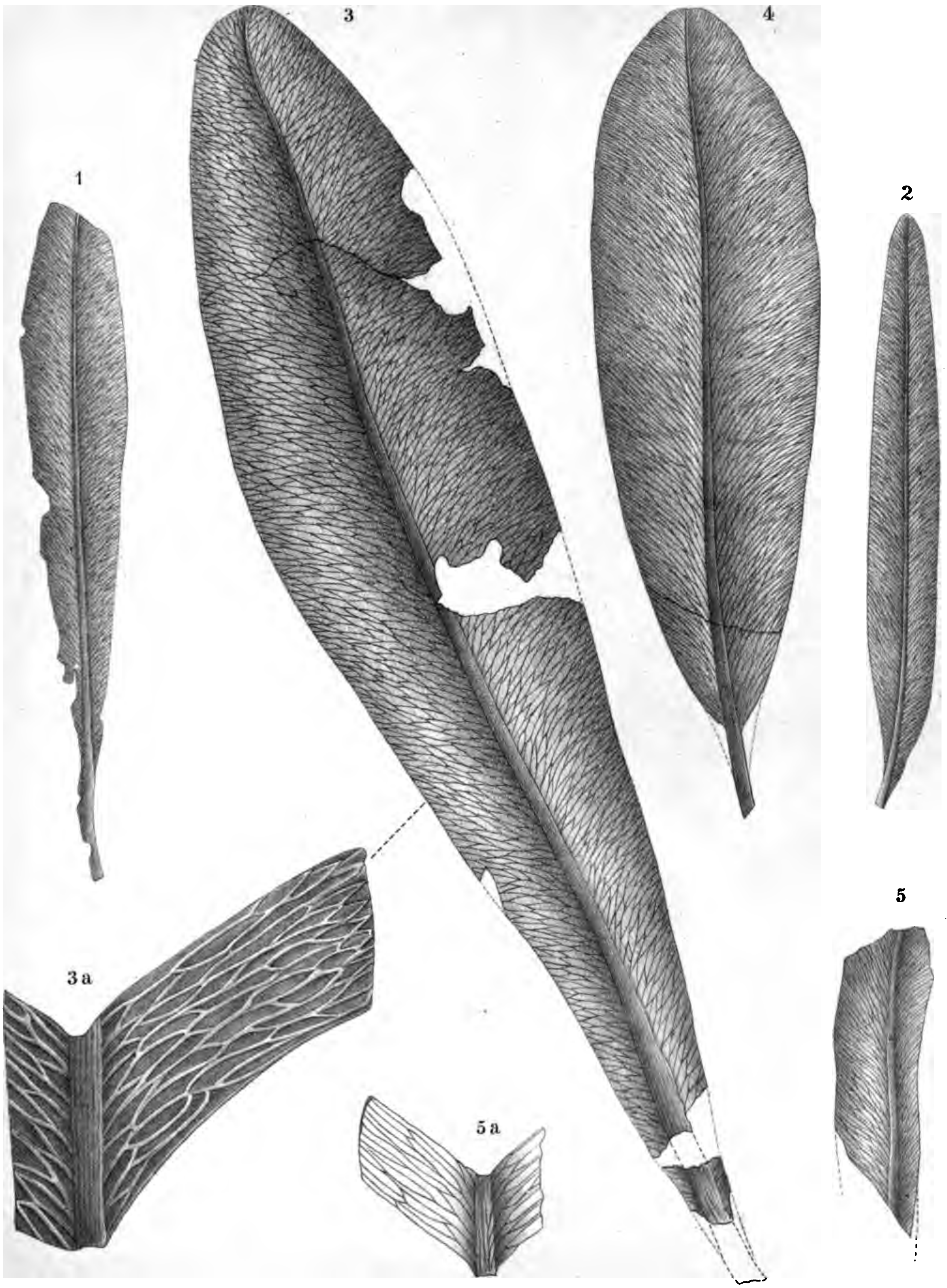

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1. 2. Glossopteris linearis Mc' Coy. 3. 4. Glossopteris Browniana Bgt. 5. Glossopteris comp. angustifolia Bgt

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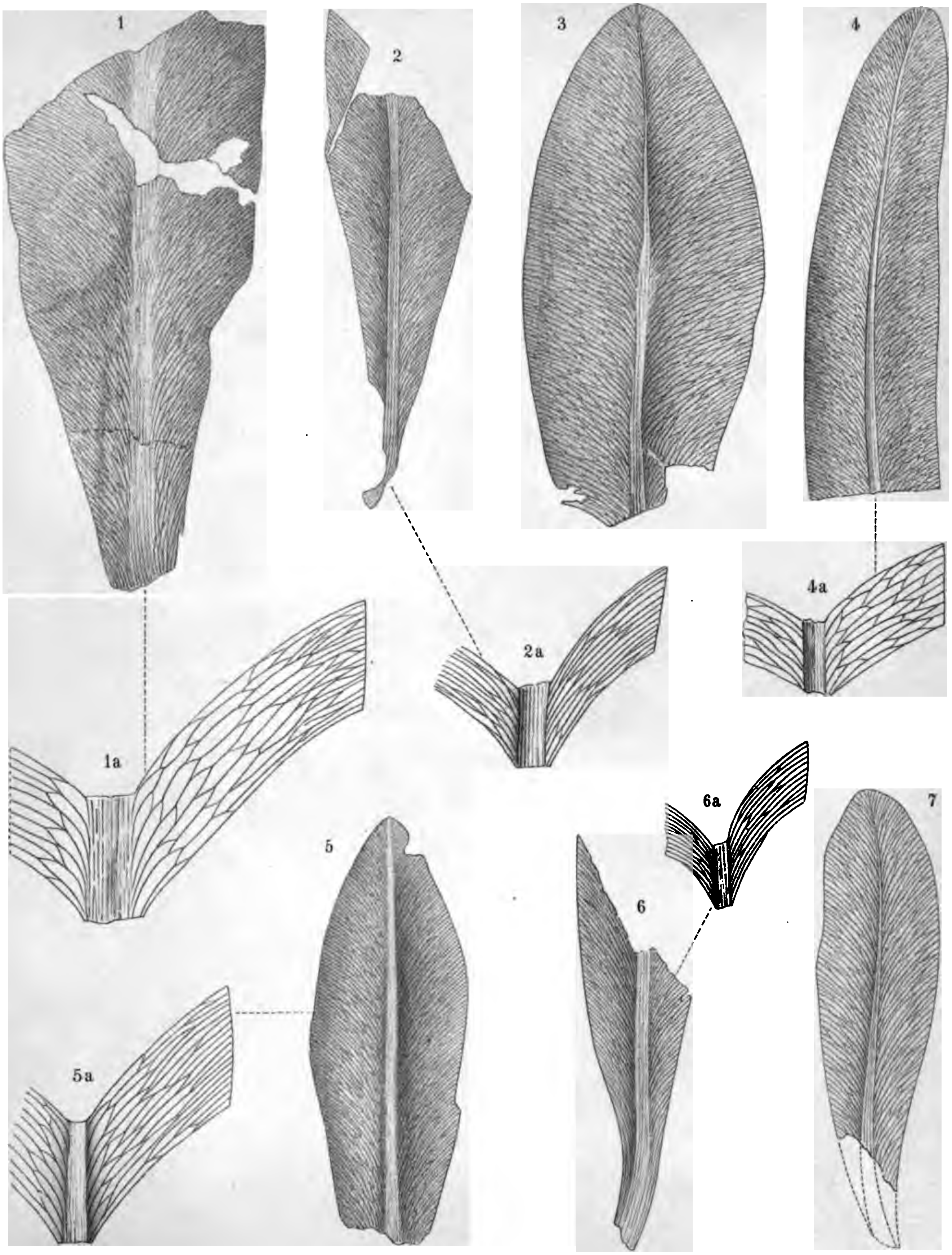

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1. 3. 4. 5. (?) 7. Glossopteris browniana Bgt. 2. 6. Glossopteris densinervis n. sp.

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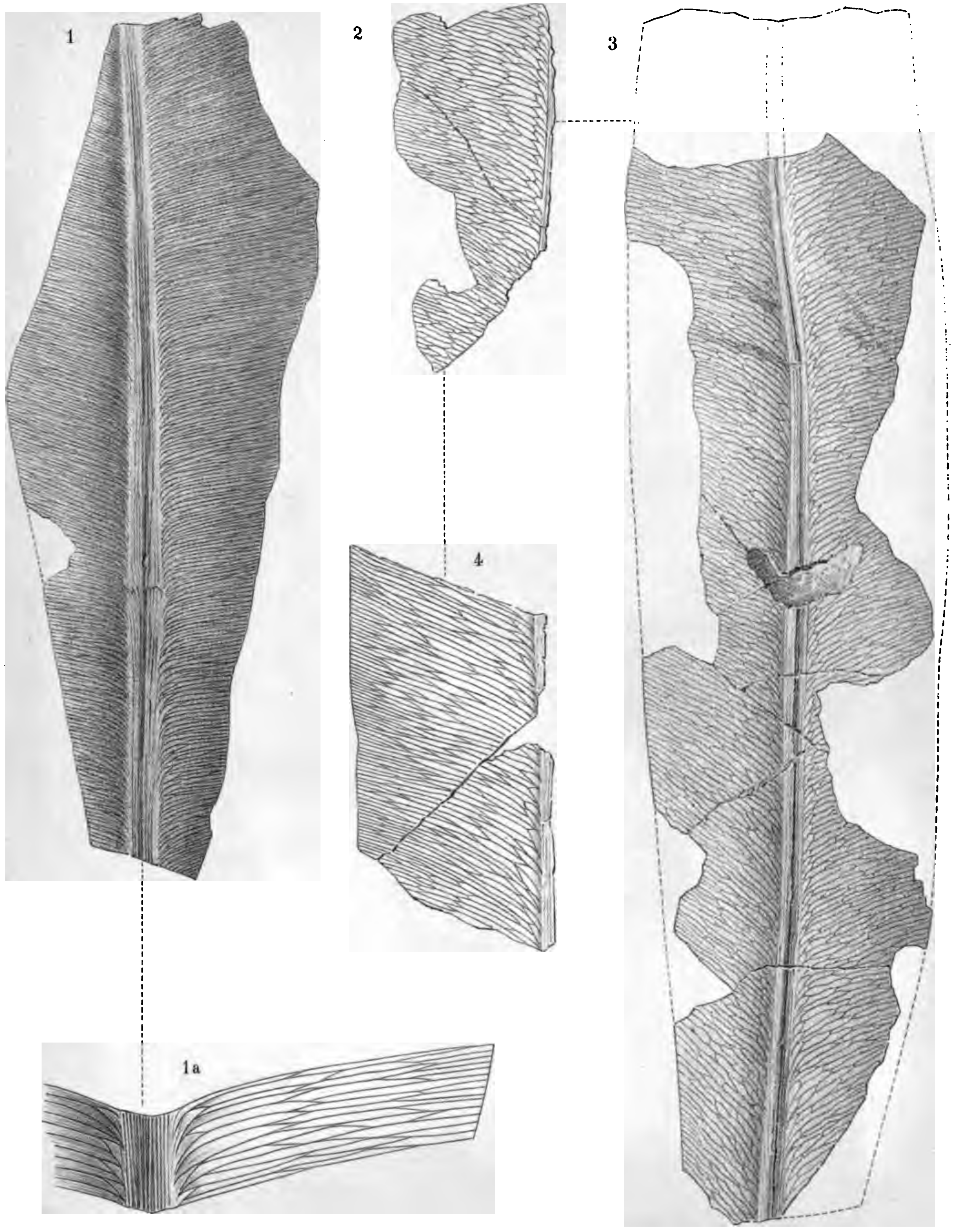

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1. 1a. Glossopteris Taeniopteroides Feistm. 2. Glossopteris parallela Feistm.

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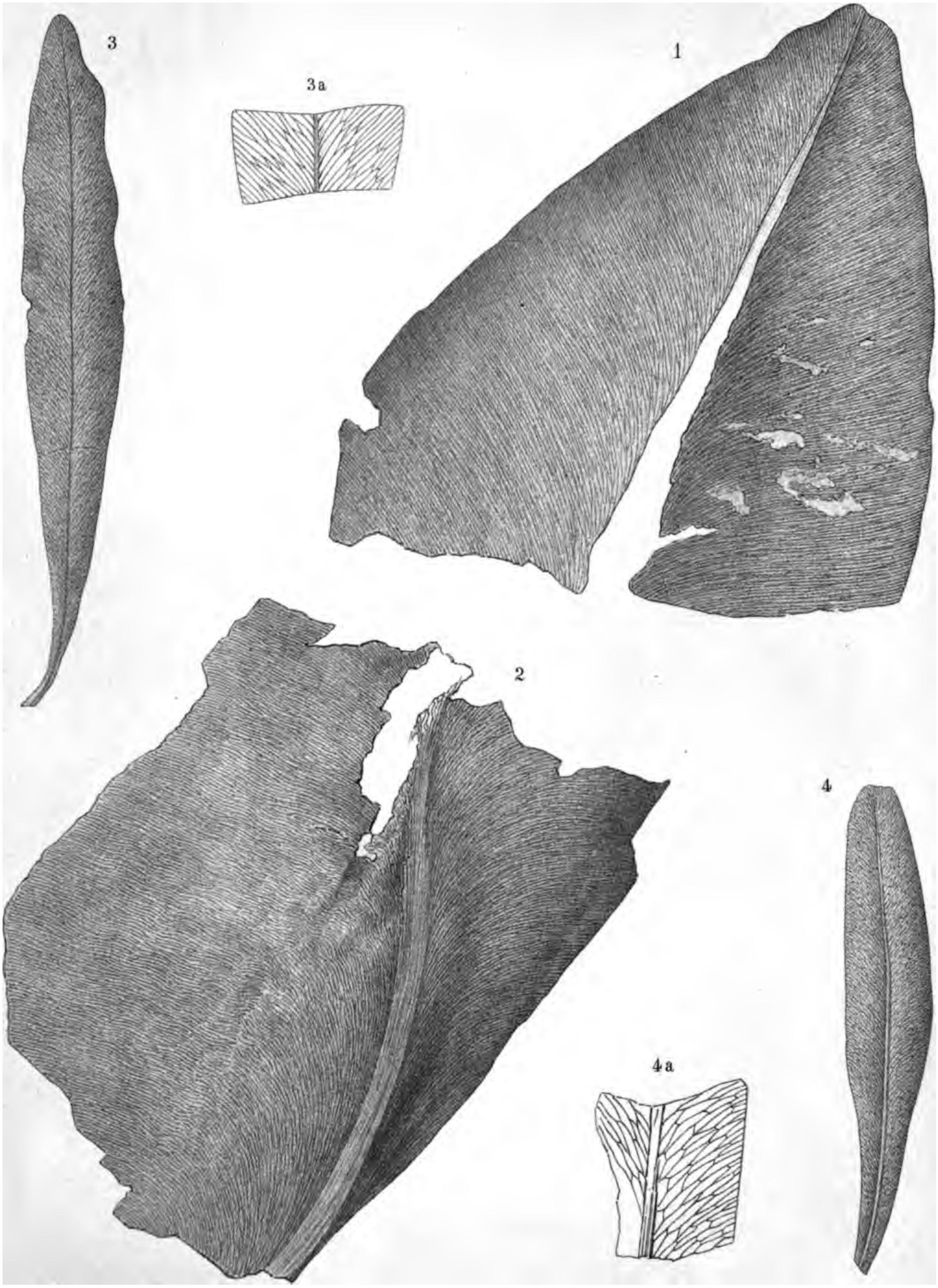

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1.2. Glossopteris ampla Dana. 3.4. Glossopteris linearis Mc'Coy.

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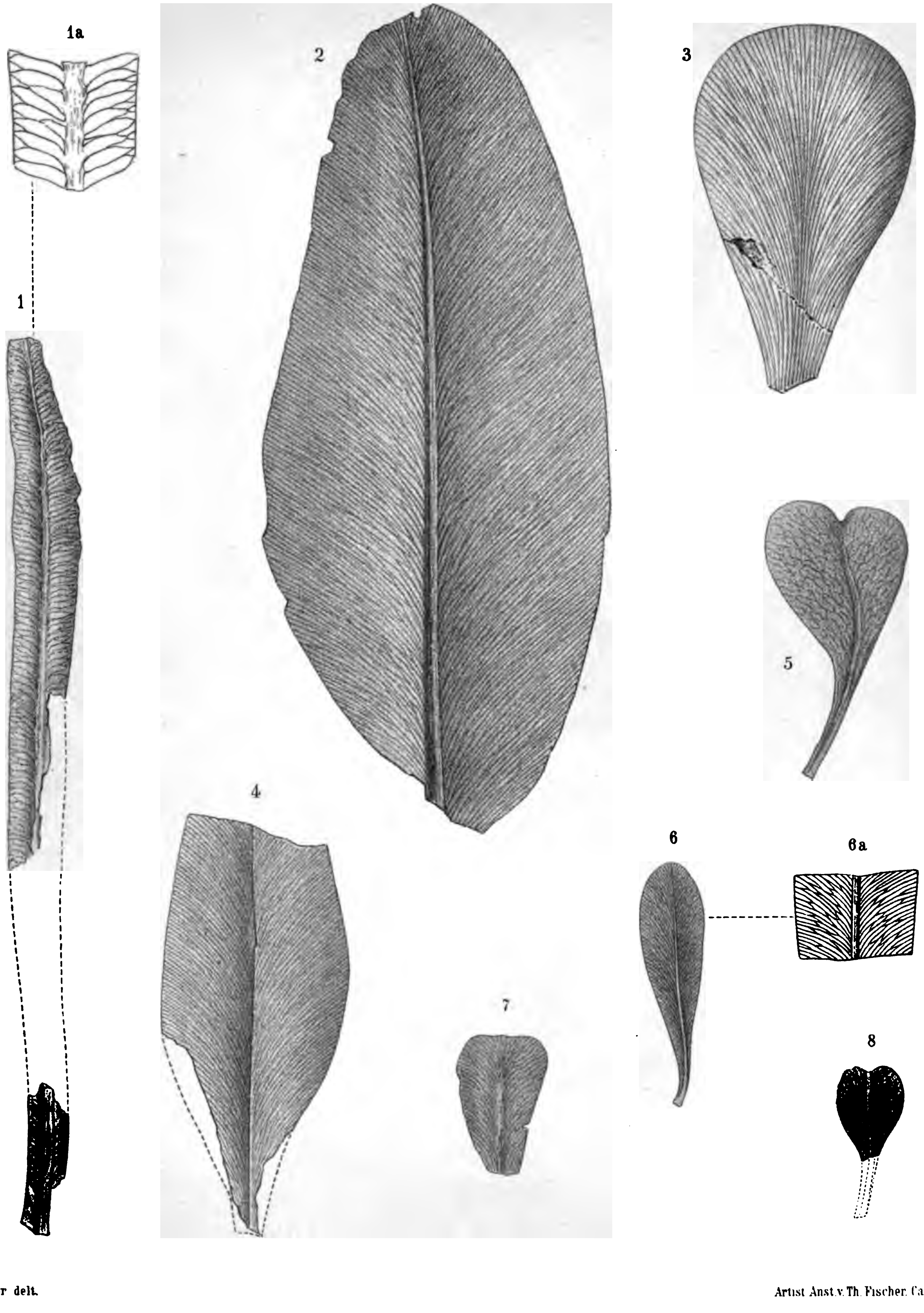

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1. Glossopteris Wilkinsoni Feistm. 2. Glossopteris browniana Bgt. 4. Glossopteris gangamopteroides n. sp.
5. 7. 8. Glossopteris spathulato-cordata n. sp. 6. Glossopteris linearis Mc'Coy.
3. Gangamopteris Clarkeana Feistm.

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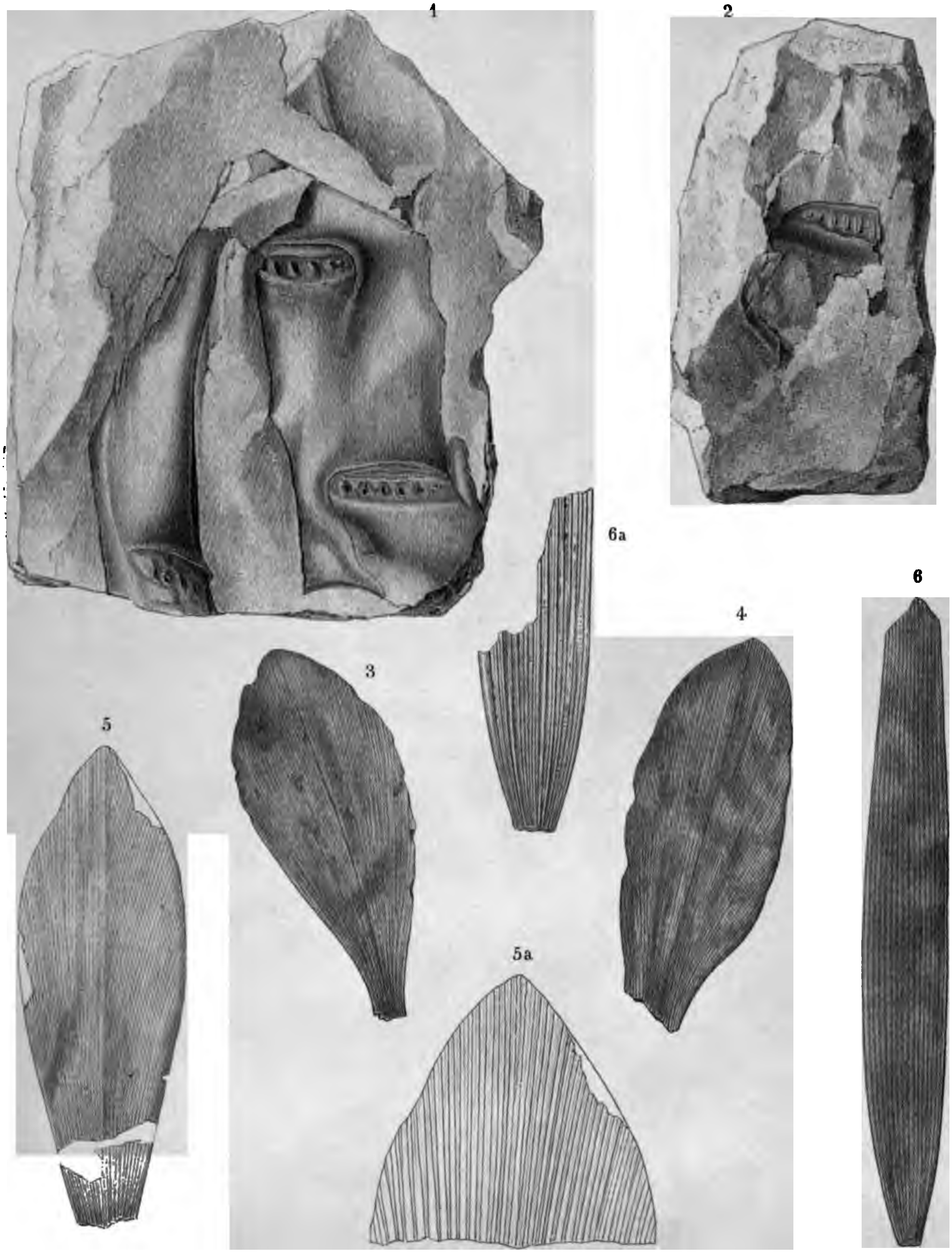

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1.2. Caulopteris Adamsi Feistm. 3-5. Nöggerathiopsis media Dana sp. (Feistm.) 6. Zeugophyllites elongatus Morr. (? Podozamites).

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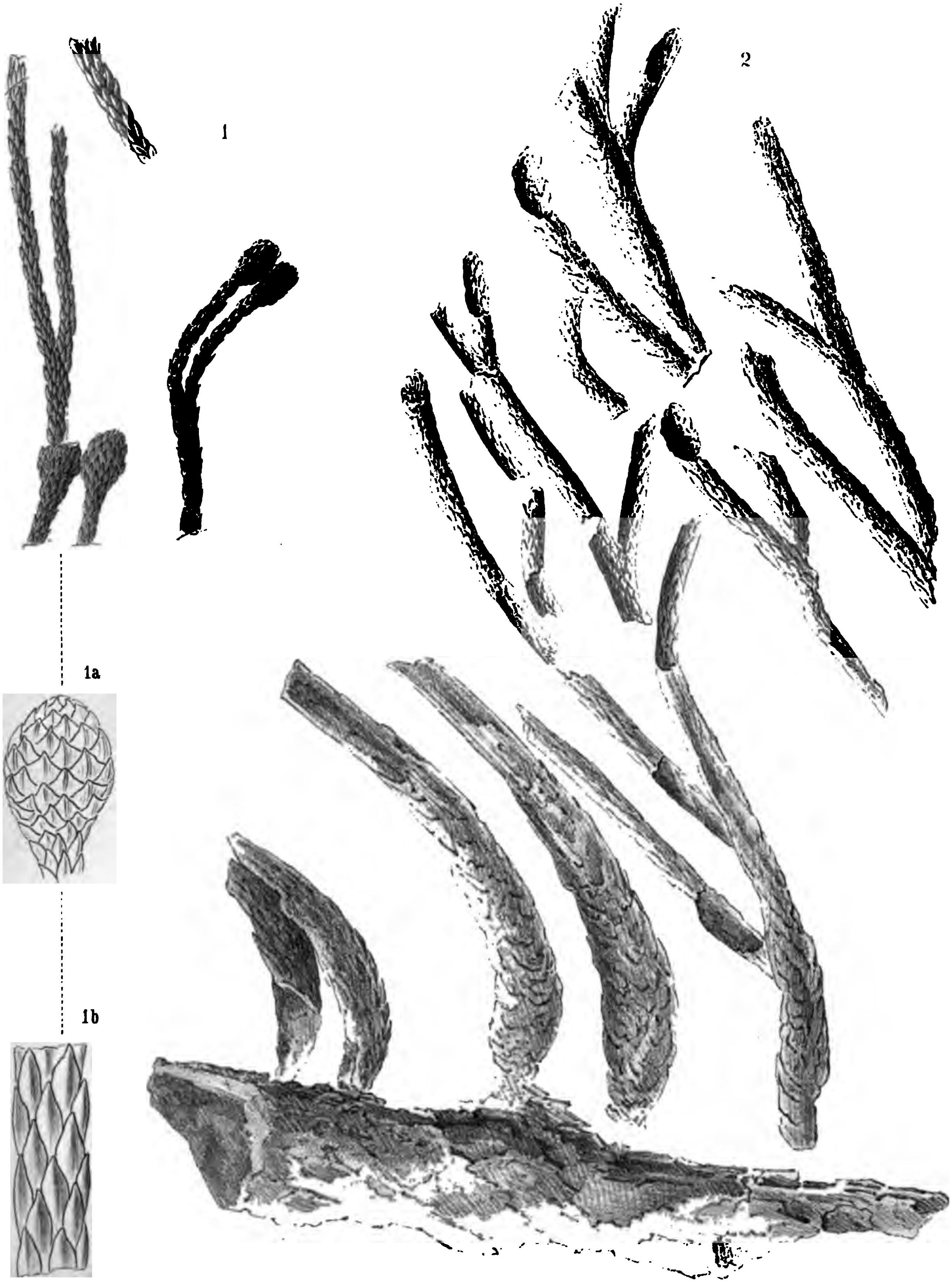

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1. 2. Brachyphyllum australe Feistm.

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Fig. 1. *Thinnfeldia odontopteroides*, Morris, sp. The upper portions of two pinnæ, which I believe have belonged to a strong forked leaf. Both show, especially in their upper portions, the insertion of the lower basal pinnula much lower down the rachis 101

Fig. 1*a*, 1*b*, 1*c*. Enlarged leaflets, showing the characteristic venation. The rachis of the leaf is finely wrinkled transversely.

Mount Victoria, New South Wales. Hawkesbury Series.

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Fig. 2. *Thinnfeldia odontopteroides*, Morris, sp. This is a very strong leaf, without furcation. It cannot be easily decided whether it is a single pinnate leaf, or whether it is perhaps a portion of a leaf already forked. The pinnæ themselves are rather strong; the lower basal leaflets are inserted pretty low down on the strong rachis, but they belong distinctly to the pinna 101

Fig. 2*a*, 2*b*. Two basal leaflets enlarged.

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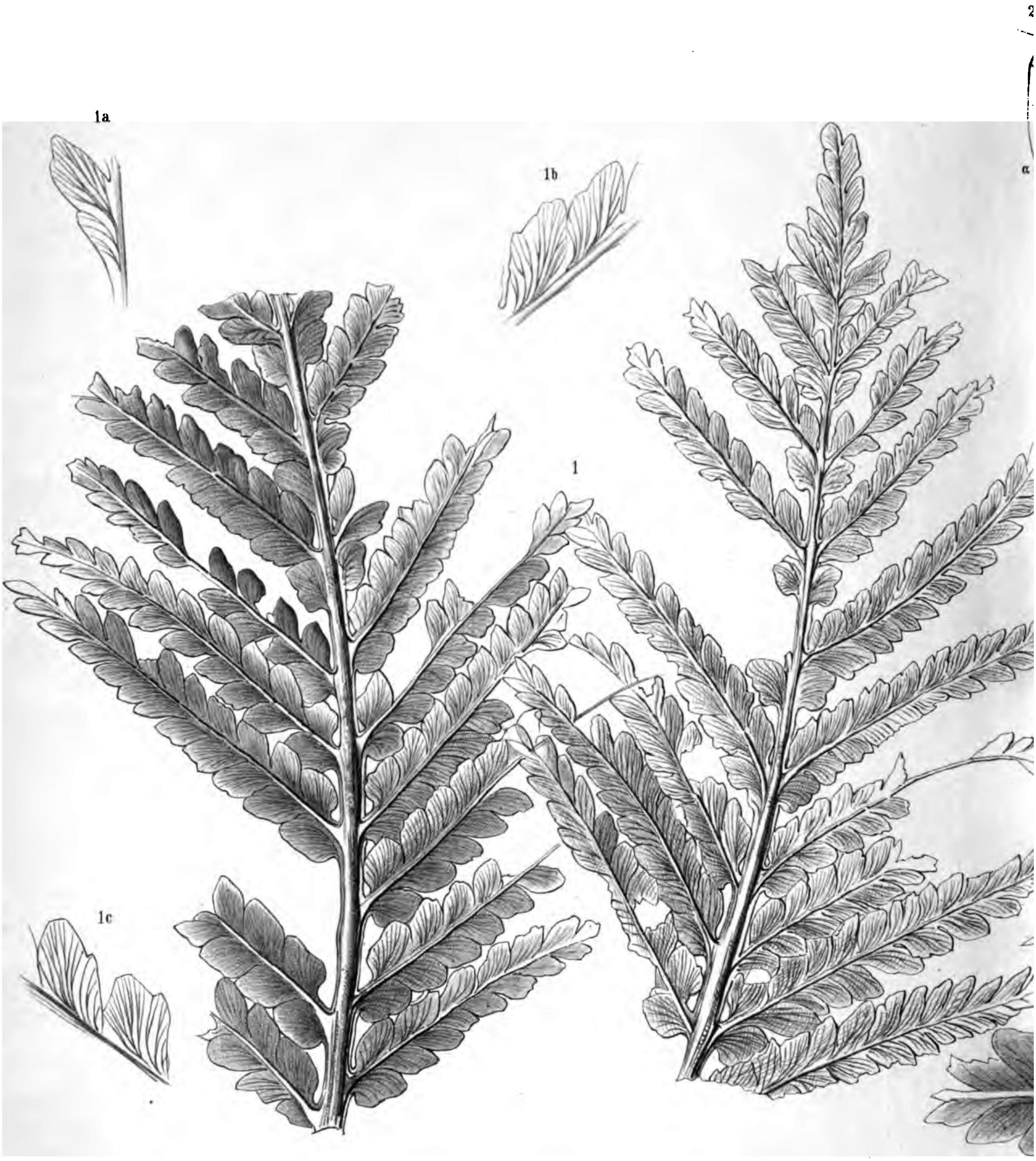

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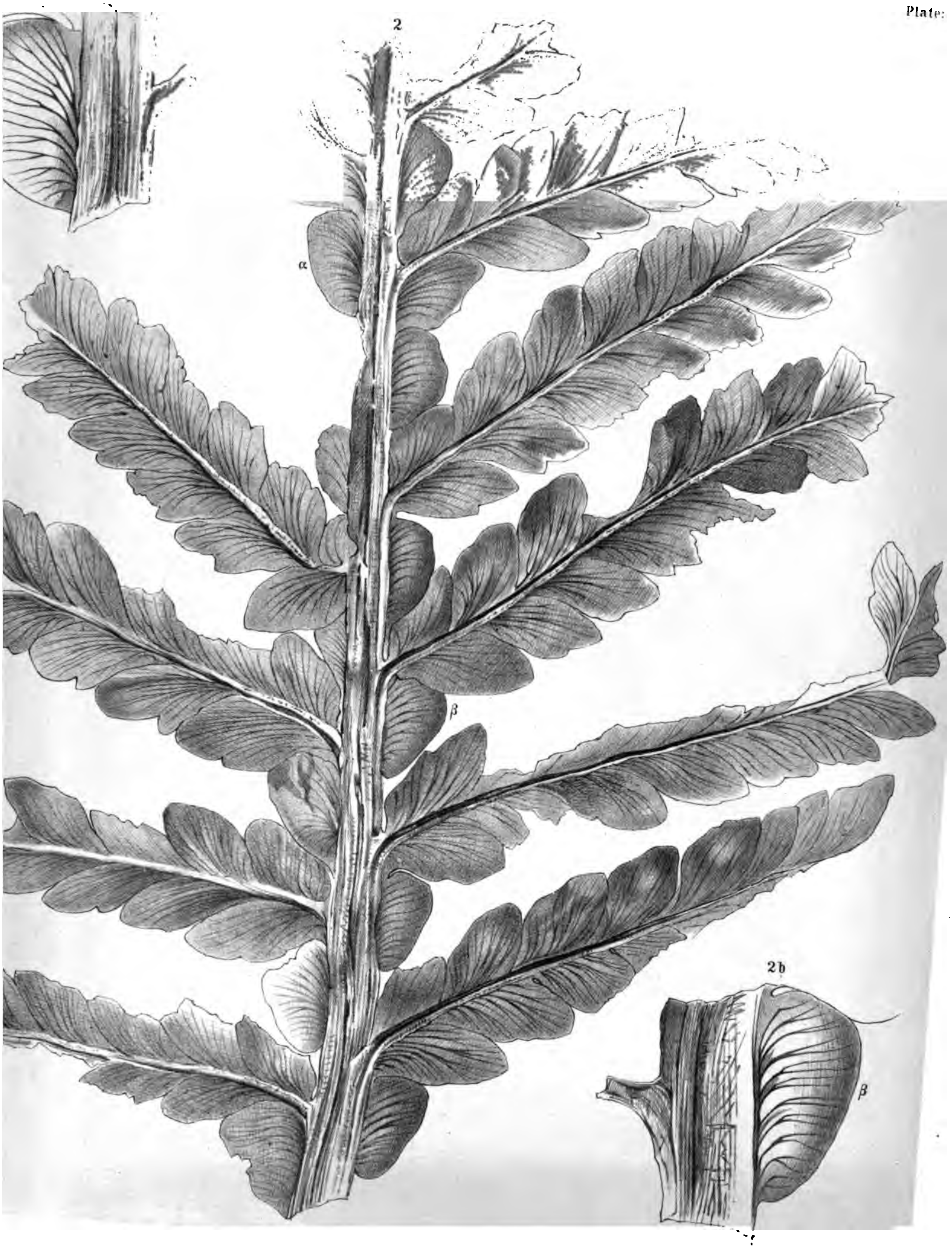
Thinnfeldia odontopte



Morr. sp.)

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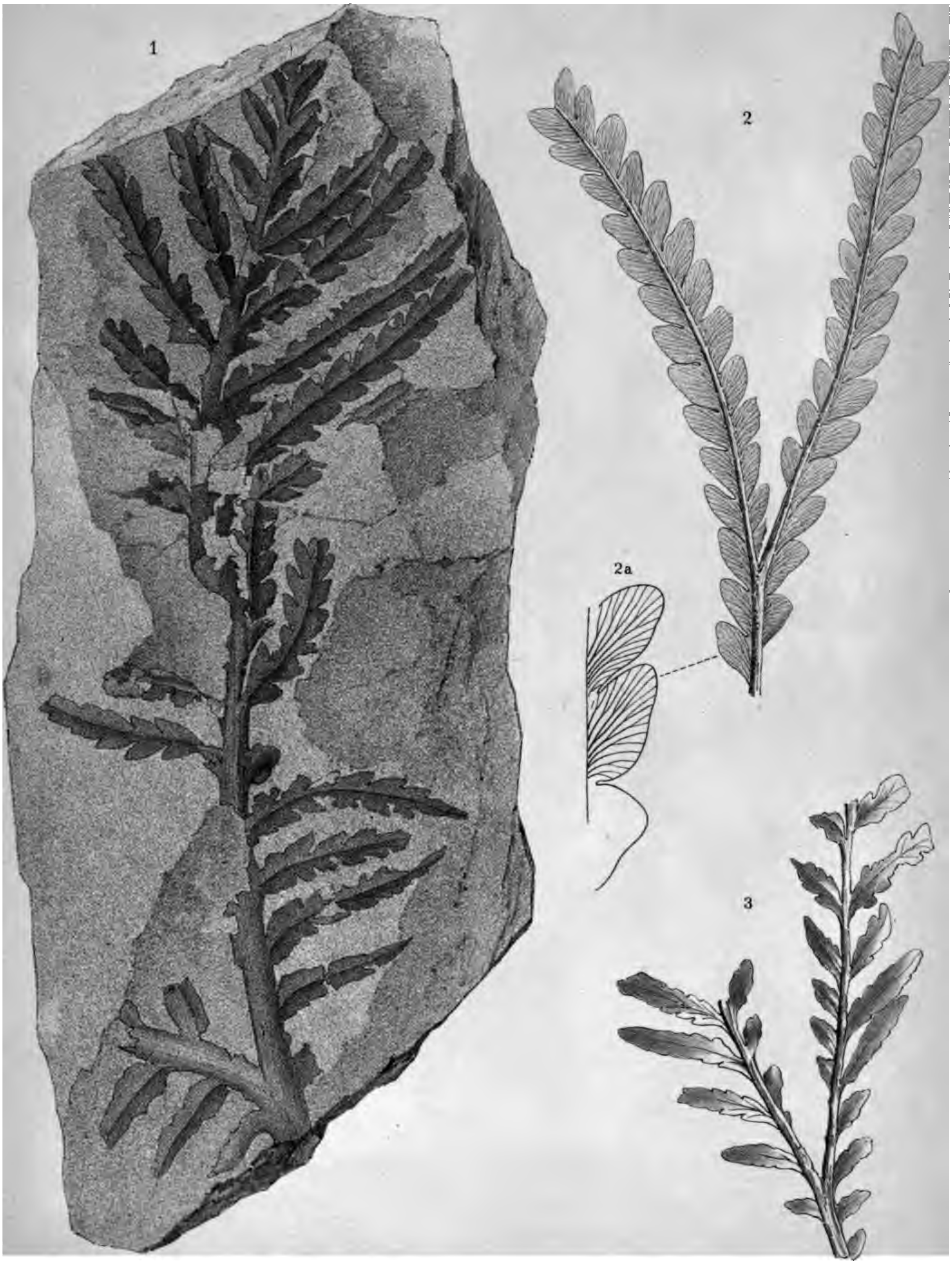

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1. 2. Thinnfeldia odontopteroides Feistm. (Morr. sp.) 3. Thinnfeldia (Gleichenia) dubia Feistm.

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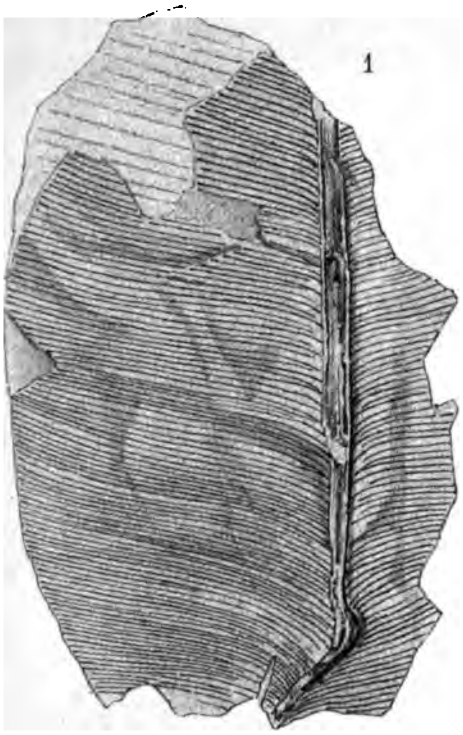

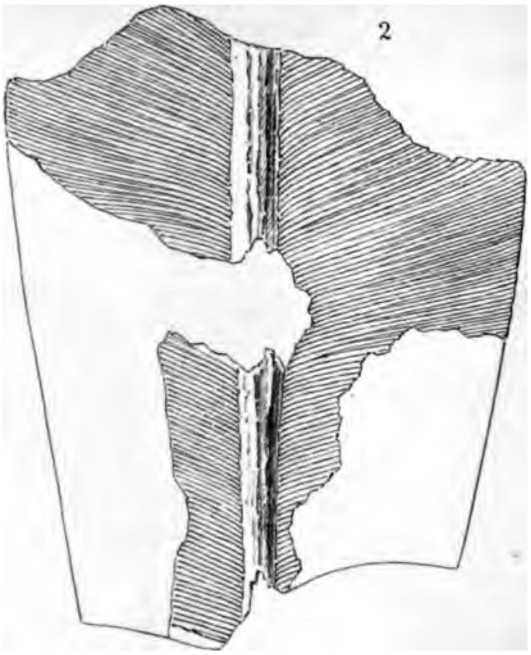

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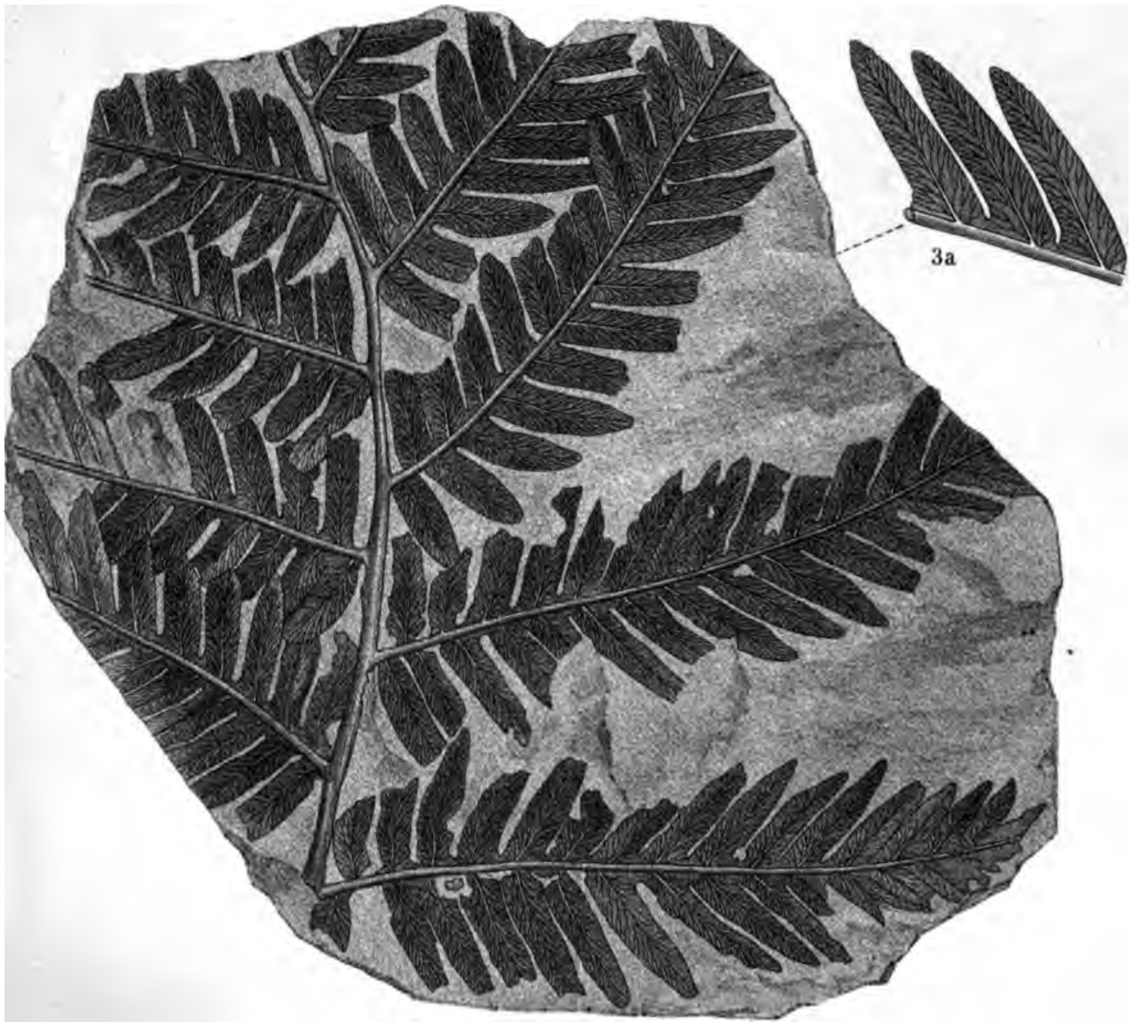

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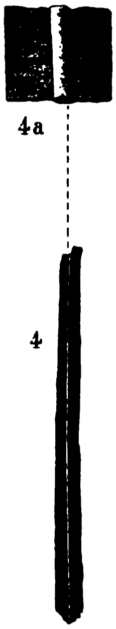

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1. 2. Macrotaeniopteris wianamattae Feistm. 3. Alethopteris australis Morr. sp. 4. 5. Taeniopteris (Angiopteridium) Daentreei Mc'Coy.

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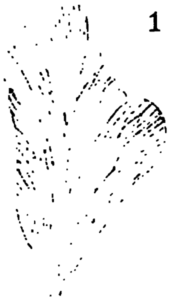

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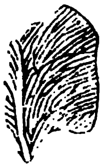

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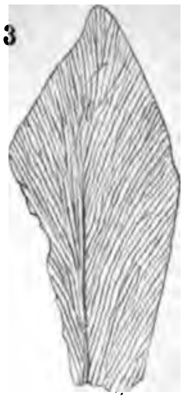

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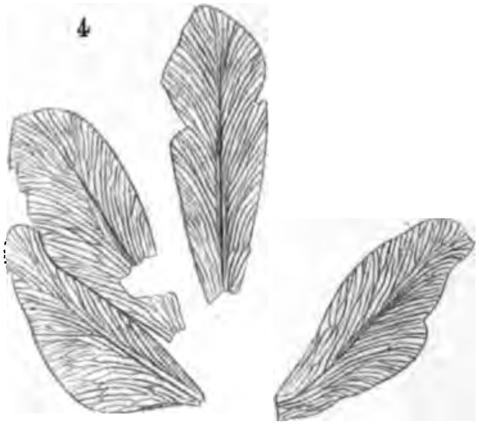

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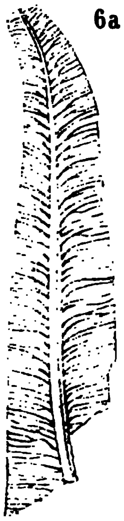

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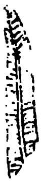

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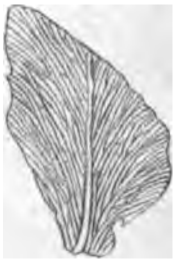

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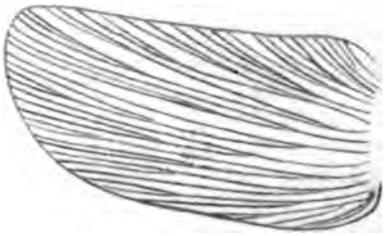

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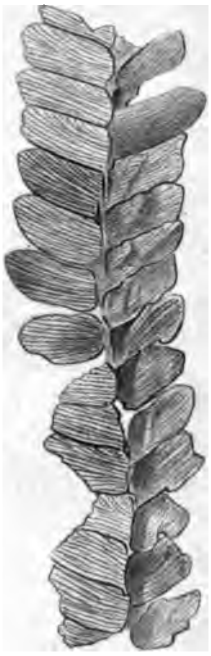

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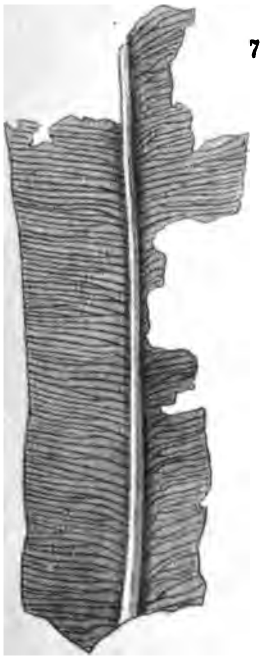

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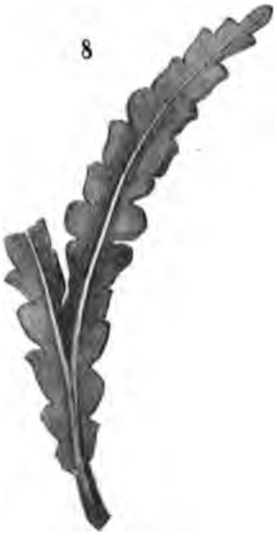

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1-5. Sagenopteris rhoifolia Presl. 6. Taeniopteris (Angiopteridium) Daintreei Mc' Coy. 7. Taeniopteris (Oleandridium) Carruthersi Ten. Woods. 8. Thinnfeldia odontopteroides Feistm. (Morr sp.). 9. Otozamites comp. Mandeslohi Kurr. sp.

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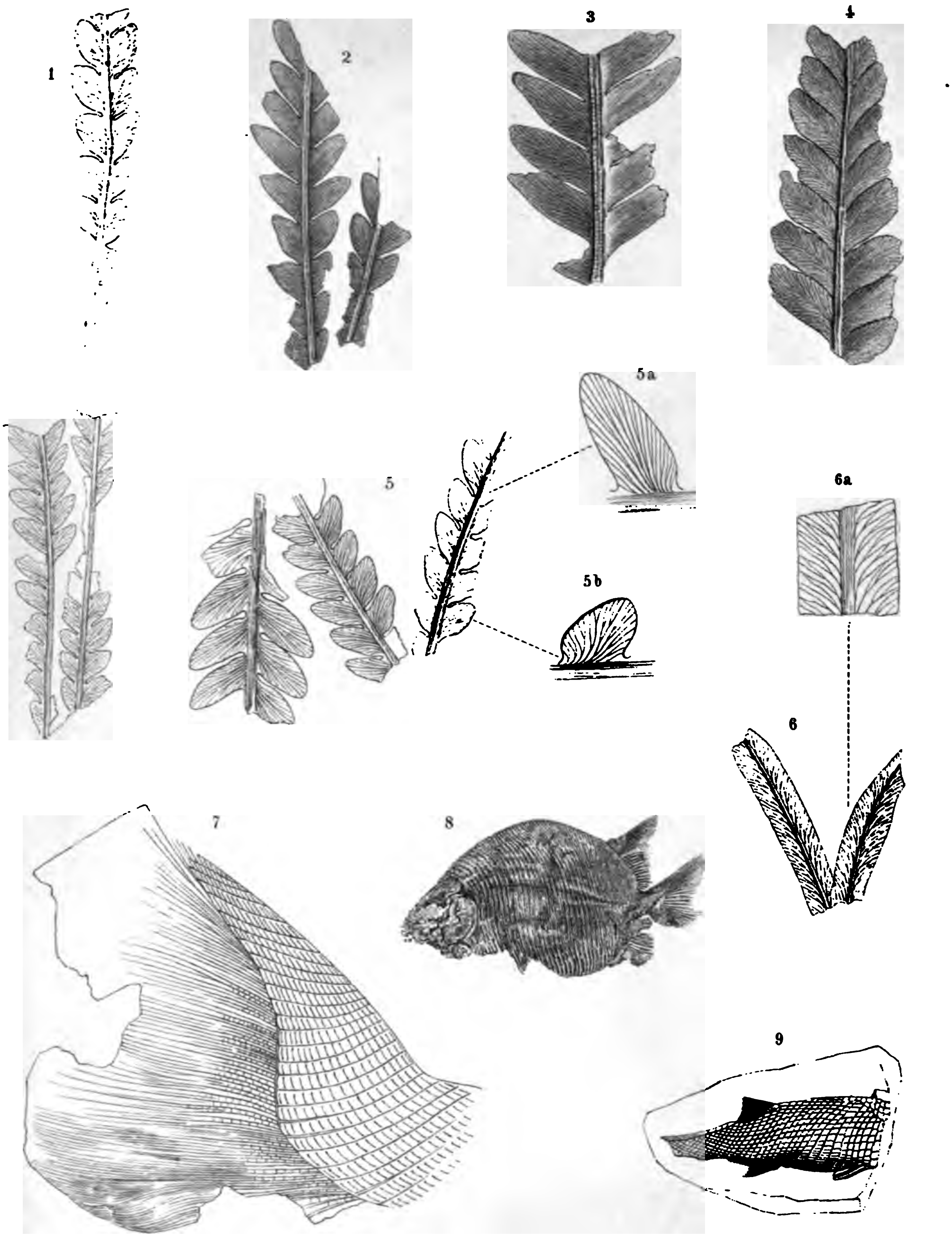

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1-5. Thinnfeldia odontopteroidis Feistm. (Morr. sp.) 6. Sagenopteris tasmanica Feistm. 7. Urosthenes australis Dana. 8. Cleithrolepis granulatus Egert. 9. Palaeoniscus superstes Eg.

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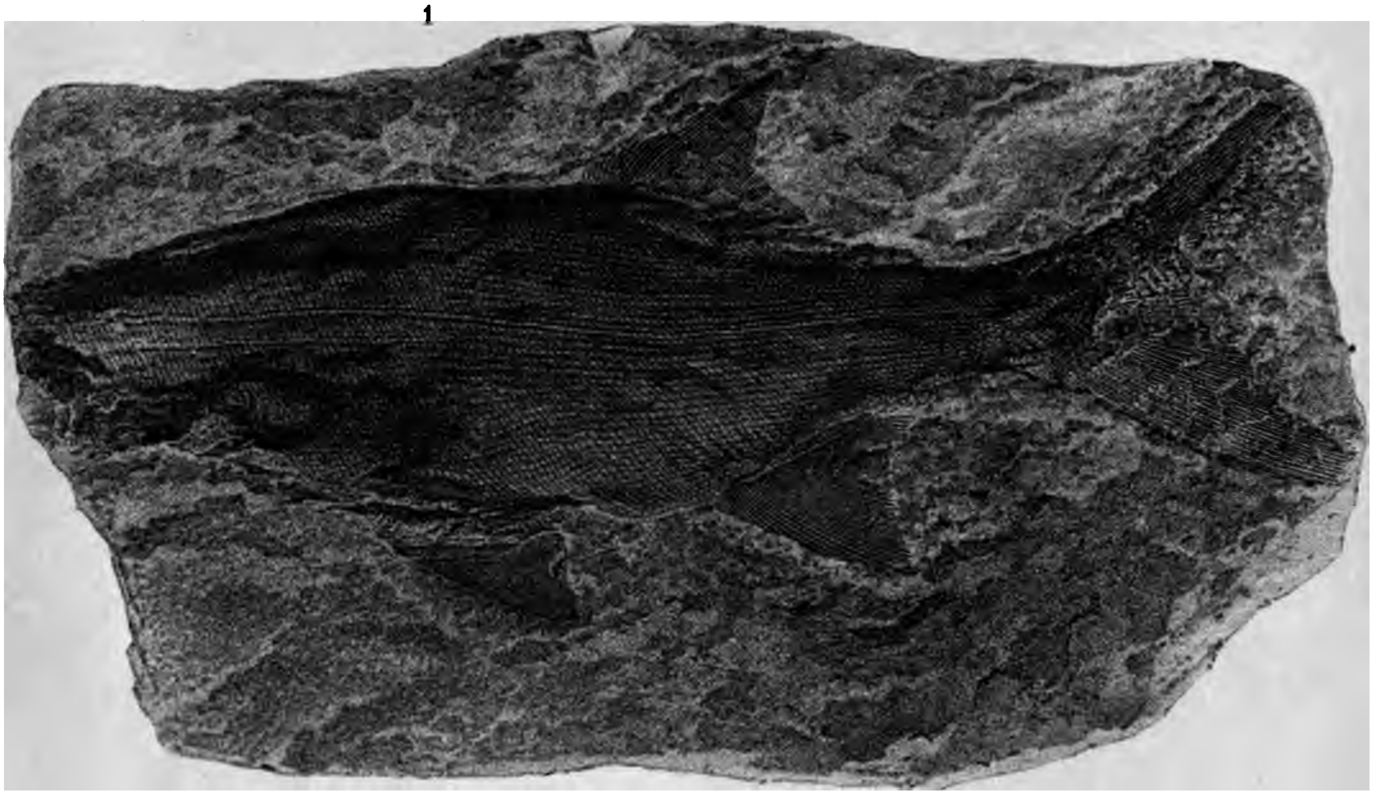

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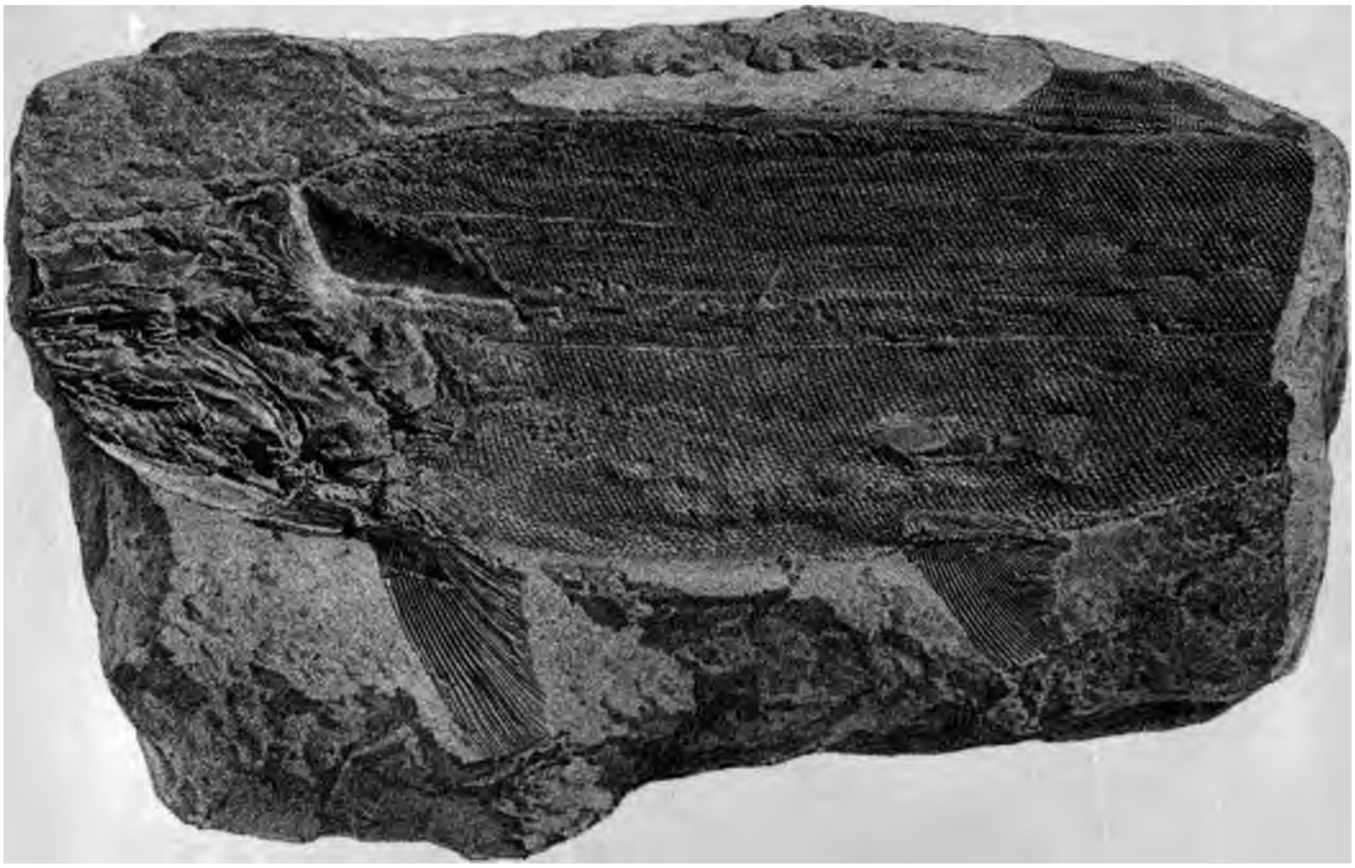

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1. Palaeoniscus antipodeus Egert. 2 Myriolepis Clarkei Egerton.

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